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A TREATISE

ON THE

CAUSES OF HEART DISEASE

WITH

CHAPTER ON THE REASON OF ITS PREVALENCE IN THE ARMY.

BY

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INTRODUCTION.

I DO not presume here to investigate the entire subject of the causation of heart disease, but shall only take some of the most prominent causes of it, and endeavour to show their action in producing disturbance of the function or alterations in the structure of the heart.

The diseases themselves I shall simply specify, as their symptoms and treatment are not properly embraced in the special province of this treatise. But if any point should seem to require particular notice, I may then take the liberty of transgressing its bounds, but shall not wander further than is absolutely necessary.

In studying the causes of heart disease, I shall also notice under each, the cardiac lesions which most commonly result in consequence, and how they can be avoided, as my aim is to prevent disease rather than to cure it.

EDINBURGH, *June* 1872.

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CAUSES OF DISEASE OF THE HEART.

CHAPTER I.

DEGENERATION.

The degenerations to which the heart and arterial system are especially liable, are of two kinds, fatty and calcareous. Along with the former we would place fatty accumula-on, not that it is in reality a true degeneration or replacement of the healthy tissue by the deposit of fatty molecules or granules. But from its history, the gradual and insidious nature of its progress, and the ultimate result in some cases, the two are so similar that during life it is hardly possible to make a differential diagnosis. Fortunately, for practical purposes, it is not of much importance. We shall very briefly describe each of these appearances, since we may have to refer to them when we come to the more special object of these investigations, as to the various agencies which come into play in their production.

Fatty accumulation, or, as Walshe describes it, fatty infiltration, to distinguish it from true fatty metamorphosis, occurs in individuals having a tendency to obesity, and sometimes in others in whom this tendency appears to be very slight, overloading the heart with fat to such an extent as to offer a serious obstacle to its performing

its function properly. This deposit of fat is, in the first instance, situated between the pericardium and the muscular substance of the heart, especially "over the right cavities at the junction of the auricles and ventricles, along the trunk of the coronary veins, at the edges of the ventricles, at the apex, and at the origin of the aorta and pulmonary artery." * In this situation the fat, by its mere weight and quantity, may seriously and fatally interfere with the heart's action—compressing and softening its muscular substance, rendering it flabby and weak, so that the symptoms and termination of the case may be almost similar to one of true fatty degeneration. Occasionally this accumulation may take place to such a degree as to form a tumour and simulate aneurism of the aorta, as in the following case:—W. H., aet. 63 when first seen by me, was suffering severely from difficulty of breathing, amounting to orthopnœa. His face was œdematous, lips purple, expectoration purulent, frequently tinged with blood, pulse weak and irregular. Bronchitic râles were heard all over the chest, and at the apex a faint systolic murmur. On percussion the cardiac dulness was slightly increased, and at the upper part of the sternum there was an area of dulness about two inches in diameter; no pulsation could be felt in this space, nor was any murmur audible; the heart sounds were rather more feeble than natural, so that although there was evidence of a tumour in this locality, it was not sufficient to make us deem it aneurismal. The patient improved considerably under treatment directed to relieve the lungs and embarrassed circulation, but died suddenly when trying to get out of bed about ten days after being first seen. *P.M.*—The heart was slightly

* Aitken, Practice of Medicine.

hypertrophied, but pale in colour and greasy to the touch; mitral valves incompetent. At the upper part of the pericardium was a mass of fat lying over the large vessels, and filling up the space between them and the under surface of the sternum.

This is probably an exceptional case, still it shows to what an extent this accumulation of fat may reach. What most commonly occurs is that the fat increases not superficially, but slowly and insidiously insinuates itself between the muscular fibres by the production of adipose tissue more or less complete. This fatty infiltration between the muscular fibres only influences them injuriously by its pressure interfering with their nutrition, and rendering them soft, pale, and atrophied; but within the sarcolemma there is no replacement of the muscular fibre by oil as in the fatty metamorphosis. This combination of fatty accumulation and infiltration—the latter being, in the majority of cases, only an advanced stage of the former—brings the heart, as will readily be seen, into practically the same condition of weakness as true degeneration does, although perhaps in a modified degree and in fewer instances, as it occurs more rarely at least to such an extent as to cause serious symptoms; hence, for our purpose, the usefulness and advisability of studying these two forms of diseased action together.

Fatty Degeneration, or Metamorphosis.—The discovery of this morbid change affecting voluntary muscle is very old, but Corvisart was the first to teach that the heart was liable to a similar transformation, and insisted on distinguishing this from fatty accumulation amid the fibre.* Laennec also made this distinction; and more recently, since the microscope has been in use, this

Maladies du Cœur, 3d edition, p. 180.

subject has been carefully investigated, and the minute changes which occur in the muscular fibres noted and described, by many eminent physicians both at home and abroad. "Fatty degeneration consists in the replacement of the healthy tissue of a part by drops, or molecules of an oily nature, which are deposited, as it seems, instead of the natural material."* In the heart the muscular fibres so affected, when seen under the microscope, show the sarcous element replaced within the sarcolemma by oily molecules, necessarily depriving the tissue of its contractile power, according to the degree to which this change has advanced. Fatty degeneration is thus a form of atrophy, but not of the usual kind, as Dr Sieveking has seen cases in which the muscular fibres of the heart were simply atrophied, and had entirely lost their transverse striæ, which yet did not contain a single particle of oil. This change seems to be affected in the way of an unhealthy nutrition, oil being deposited in the blood in the place of nitrogenised matter. What appears to render this idea the more probable, is that sometimes oil is found outside the sarcolemma, even when it is entire, as this membrane is last subjected to degeneration, and only in extreme cases. In the earlier stage of this change we are exposed to a fallacy which it is as well to notice. Dr Ormerond has observed that the transverse striæ are, in the normal state, less distinctly marked in the cardiac than in voluntary fibre; and this is true of the adult heart, so that a slight want in the clear definition of the striæ should not be taken, *per se*, as a sign of fatty metamorphosis. This change has also been noticed in hearts which at some former period have suffered from inflammation; in them it is probably due

* Jones and Sieveking, Pathological Anatomy.

to interference with their proper nutrition. There are also some cases, comparatively rare, which do not, strictly speaking, belong to the class we have been describing, but being few in number and terminating in fatty degeneration, need not be placed under a separate category. They are those in which there is a deposit of fibrous tissue about the heart, especially at its base, increasing its thickness and encroaching upon the muscular substance. These cases all show evidence of previous or existing pericarditis, and this material, as well as the sarcous, undergoes degeneration, so that it may more properly be regarded as a complication than as a separate form of this morbid process. Fatty degeneration affects especially the ventricles, most frequently the left alone, and very seldom and in a less degree the auricles.

Calcareous Degeneration.—This form of the morbid process seldom affects the heart itself, unless on the substance of atheroma, tubercle, or induration matter, in or upon its tissues. More commonly it is found in its arteries of supply, the coronary arteries, and in the large blood vessels where it seems generally to follow upon atheroma of their walls. Accordingly, we will study these two changes together, the calcareous being only a more advanced stage of the former. *Atheroma* or fatty degeneration of the arterial coats, is in its nature essentially the same as that which occurs in the muscular substance of the heart. It first commences in the connective tissue composing the innermost layers of the internal coat, gradually destroying it in its progress. The arteries and valves of the heart, where atheroma is most frequently found, are prone to subsequent calcareous change, because this deposition usually takes place in tissue of impaired

vitality, as in lymphatic glands which have been the seat of scrofulous disease. In connection with this subject of degeneration, there is a point which we would not like to pass over, as it is the subject of some dispute, namely, the relation between it when affecting the heart, and disease of the coronary arteries, as to cause and effect. In some cases in which the coronary arteries are only slightly atheromatous, without their calibre being diminished, they cannot be justly considered a cause of fatty degeneration, if in these cases it is found affecting the muscular substance of the heart. It is only a manifestation of the general tendency of the tissues to that morbid change. Again, we know that if the arterial supply to a part is diminished or cut off, it is rendered more liable to degeneration; so in the cases in which there is obstruction of the coronary arteries to a great degree from calcareous deposit, we do not doubt but that in them it may induce fatty degeneration. But the arteries being in that diseased condition, show that the heart is also more prone to it than it would otherwise be. We must also remember that fatty metamorphosis might have occurred in the heart previous to the obstruction of the arteries, so in these cases it would simply act as a spur to the more rapid development of the morbid process. In some, obstruction of the coronary arteries may be the cause of the degeneration of the heart, if they are first affected; in others, they are in all likelihood both attacked about the same time, so that it just resolves itself into this curious and impractical question—which was probably the first affected, the muscular substance, or the arteries, or whether in them it did not commence simultaneously, being in both the result of the same degenerative process. There is another form of degeneration which we

shall only mention, *the waxy or amyloid.* It is sometimes met with in the heart when the kidneys are labouring under this disease, but it seldom if ever causes any disturbance of the function or structure of the heart sufficient to give rise to distinctive symptoms.

Having thus briefly noticed these different forms of degeneration, let us now more minutely inquire into the conditions under which they are developed. The very term, degeneration, applied to these changes, contains a volume of meaning as to their etiology. It is the result of a failure or impairment of the vital powers, inducing alterations in the structure of certain tissues and organs more than in others, so as to interfere with their action. This process, when once it has commenced its work of destruction in any tissue or organ, renders the part so affected more liable to its further ravages, hence its intractability to treatment. Whatever weakens the body and lessens its vitality predisposes to these degenerations, as intemperance, syphilis, Bright's disease, gout, phthisis, etc. In its progress degeneration is generally slow, sometimes even it seems to remain in abeyance for a time; but possessing this fatal quality of predisposing by its presence, it is only acting the more dangerously because concealed. The slow and insidious nature of the disease accounts for the frequency with which it is overlooked, and the difficulty there is of recognising it in its earlier stages; there being no fear of such a danger lurking within until perhaps an attack of angina or rupture of a ventricle brings the case to a sudden and fatal termination without previous warning, at least anything that would so explain itself to the unprofessional mind. Considering, then, the nature of this disease, its gradual and secret advance, and its frequently

fatal termination, it behoves us all the more to examine into its origin and cause.

The life of man is an allotted span, hence death is as natural as life; yet no one doubts but that, within certain limits, he can prolong his life by living in accordance with such rules as are most conducive to maintain the vital economy in as perfect a condition as possible, by preserving it from all internal and external agencies which predispose to disease by interfering with or permanently injuring the machinery of the human body.

The gradual development of the body from childhood to manhood, the maintenance of the full powers during the prime, and their decline with the advance of years, are changes all following and obeying natural laws. This decline in later years does not, however, constitute degeneration in its true signification, although by many believed to be synonymous.

We admit that in very few instances is nature allowed to fulfil her destiny, slowly to expend her powers, leaving behind no trace of disease, but simply atrophied tissues, altered not so much in structure as by diminution in bulk.

This is rare, still we meet with such cases, and it is their rarity which has led pathologists astray; for in the majority we find traces of degeneration, and this may have led to the erroneous supposition of its being a natural process.

Sir Duncan Gibb read a paper on centenarian longevity at the meeting of the British Association, August 3, 1871. His observations had reference to the physical condition of centenarians, which helped to show how they were enabled to reach so great an age, and were derived from a comparison of four genuine examples he

had himself seen. Of these four two were males, each 103 years of age; and two females, aged 101 and 102. In all four the functions of respiration and circulation were performed with the most complete and perfect integrity, there being an absence of those changes usually seen as the result of old age. The chest was well formed, and of good capacity; the cartilages of the ribs were not ossified, the voice was good, clear, sonorous, and powerful, though a little cracked and tremulous in tone. The heart was quite healthy, and free from the chief source of trouble in old persons—namely, fatty degeneration. There was an absence of the athermatous changes commonly observed in those of great age. All the special senses were unimpaired except hearing. The eye was clear in all, the sight excellent, all could read ordinary type without spectacles. There was no *arcus senilis.* The sense of smell was good; none smoked, used snuff, or chewed tobacco. The mental faculties were active in all, the memory good. The general health was capital in all, appetite and digestion good, and all possessed sound teeth. Taking, then, the condition of mind and body presented by these four undoubted centenarians, it may be said that in all there was an absence of those changes of a degenerative type which are generally noticed in persons approaching the allotted period of threescore and ten. It must also be noted, however, that complete composure of mind throughout life has much to do with the condition of the body permitting the attainment of such great longevity, and there was no hereditary taint to interfere with nature's laws in any of these cases. To reach so great an age not only must the constitution be a good and healthy one, but all the great functions of life must be performed without any impediment. If the special senses are co-

ordinately good, they assist in keeping up the condition favourable to longevity. But there is one change in particular antagonistic to extreme longevity, and it is the most important one,—namely, the presence of atheroma in the blood-vessels, or degeneration of the substances of the heart. And why, it may be asked, are those cases so few? Simply because, in the present age, circumstances combine against the mode of life conducing to such a happy result. The great and increasing competition there is in all professions and trades; the close application and long hours of labour which are imposed especially upon such as are eager in the pursuit of wealth, or of professional or scientific reputation; the over-crowded and badly-ventilated houses for the labouring classes, in many destroying after a time the healthy appetite, and inducing a craving for stimulants; indulgence among the better classes in food and drink, insufficient exercise,—all these, and many other moral as well as physical causes, are in operation against us.

Perfection is the exception. When attained in any work, it is the result of accuracy in every minute detail, and to maintain it requires constant care to guard against everything that may tend to impair it. Yet how seldom, even in the case of the human body, originally perfect in all its mechanism, do we find that mechanism in its original entirety! Certainly it is no light work, but it is a duty, it ought to be remembered, to endeavour to bring it into that condition, or as near it as lies in our power; we say or as near it, because in many its attainment is an impossibility, often from no fault of the individual, but on account of inheriting a tainted constitution. Hence how careful it behoves us to be, as the evils resulting from our follies do not always end with ourselves, but may go on multiplying

themselves and inflicting misery upon future generations. This fact of hereditary transmission of physical and moral deformities cannot be too strongly impressed. It is a degeneration, and to it are no doubt due many diseases of the body and mind which help to fill our hospitals, asylums, and jails; for many thus inherit a depraved mental organisation, giving them an enfeebled power of will to resist the indulgence of their appetites, which may gain a hold upon them quite unknown to the possessor of a healthy body and well-regulated mind.

In a large manufactory the manager does not put any one, independent of qualifications, in charge of the engines: if he were indeed to do so, he would be justly considered unfit for the post; but he selects one who has made such machinery his study, and who alone, on producing evidence of ability, is chosen for the work. Yet, among the mass of the people, how very few know anything about the machinery of their bodies, of which they, like the engineer, have the full control, of the means requisite to keep it in good working order, and the dangers to which it is exposed in everyday life! In how few, if in any, schools, except those of medicine, is instruction on such matters given; and, until this be done, it is almost useless to preach about prevention, since the people are ignorant of the very principles on which they must act.

We think this is a subject for Government to take cognisance of, especially when so great an effort is being made on behalf of education. The common laws of hygiene and physiology should be taught in all schools, in the most advanced classes, as it certainly far surpasses in importance many of the other branches of instruction; and there can be no doubt that in a short time

it would return good interest, and that future generations would appreciate the forethought of their ancestors. This simple act would do more real and lasting good by preventing, than all the doctors in the country do in curing, disease.

That these degenerations cause many serious lesions of the heart and circulatory system, we have abundance of proof in the frequent occurrence of fatty heart, angina pectoris, disease of the coronary arteries, affections of the valves, degenerations of the arterial coats, causing in some cases aneurism, dilatation, or rupture, and many serious changes in other organs; but at present we confine our attention to their effects on the circulatory system.

All the degenerative changes in other organs are just the manifestations of the same process, giving rise to appearances and symptoms according to the structure and situation of the tissues or organs in which they occur; so in describing the history of degeneration in one organ we describe it in all. In examining degeneration, we have seen that all the changes point to impaired vitality as a necessary, if not the chief, agent in their production.

The deposit of fatty matter in muscular fibre, or in the arterial coats, with subsequent calcareous change, are instances in which the original tissues are replaced by material lower in the organic scale, indicating a want of vital power. This nervous debility is in all probability due to some change in the circulating fluid, by which it is either deprived of some of its necessary constituents or loaded with abnormal products in addition. Soon, however, the tissues suffer by this impairment of their nutrient supply, and then we have two conditions at work producing disease, an altered state of the blood, and an altered state of the part to be nourished. But there is

still a third cause to be noticed, namely, an influence of the nervous system, though whether this takes place last, or is indeed the first change, is not well determined. All these are deviations from the three conditions which are essential to health, viz.—

1. A right state, composition, and supply of the blood.
2. A certain influence of the nervous system.
3. A natural state of the part to be maintained.

Of these three conditions necessary for the preservation of the body in a state of health, the first two are the most important; as the third, in a certain measure, follows their observance. We have already said we do not know which of the first two of these conditions is primarily affected in disease; but from their intimate relation and the invariable implication of the other when one is deranged, it is of little consequence in what order we consider them, so long as we remember that fact, and that in most cases the morbid change is the result of a combination of evils. The blood is a complex fluid, holding in solution various substances for the nourishment of the different structures comprising the body, each tissue having the property of selecting what is most suitable for its own special wants. The difference in the composition of bone, muscle, ligament, nerve, &c., shows the necessity for the blood containing so many different constituents, and for the food out of which it is elaborated being also varied. What happens if people are fed for any length of time on articles of diet deficient in this proper combination of ingredients is well known. Scurvy is perhaps the most common of these results, and by experience it has been proved, that a diet imperfect, not in quantity but in quality, from the want of a suitable proportion of the constituents necessary for the maintenance

of health, speedily causes inanition and death. From this we see the danger of the balance of health being disturbed through imperfect dieting. Knowing this, we might imagine that this law being attended to was all that was necessary to restore the failing powers of nature when by any means they had been tampered with, but we must remember, that not only do the tissues suffer from defective food, but that the organs of digestion, whence the blood is supplied, are liable to be deranged, and that merely giving up what has injured them is not always sufficient to restore them to a normal condition. After the blood has supplied the tissues, it receives many effete matters, which it has to get rid off by the lungs, skin, or kidneys, and which, if retained, would act as poisons, and often cause fatal results. The three conditions, then, which are requisite to keep the blood in a state compatible with health, are—1st, Sufficient and proper diet; 2d, Healthy condition of the digestive and blood-forming organs, where that fluid is prepared and elaborated ; and 3d, No hindrance to the separation of its effete matters. Interference with the fulfilling of any one of these conditions, is followed by certain deviations from the standard of health.

We shall now consider those deviations which predispose to the occurrence of degeneration of structure, especially of the organs of circulation. Affections of the heart, due to this cause, are rare before the period of middle life, and the tendency to their occurrence increases after that, in proportion to the advance of years. This is due, we believe, not to degeneration being a natural process, but because it is a change essentially chronic in its nature, the causes acting slowly, and old age thus favouring its development. In youth, when all the bodily functions are in full vigor,

exercise is almost involuntary. At school, cricket, football, and other games are followed so eagerly, not because of the healthy nature of the exercise they entail, but from the innate feeling of the necessity the body has for exercise, and to encourage its growth and development thus manifesting itself. Later in life, when business or professional duties abridge the time at our disposal for recreation, we begin to feel the want of it and take it like medicine, convinced that it is essential for our health, but still a disagreeable necessity. If we neglect to do so, as too often happens from laziness, a feeling of disinclination is soon engendered. This unfortunate tendency, which supervenes with the approach of years, to give up exercise instead of simply modifying it, is one fraught with danger. We lose by it the best stimulant to digestion; to the tissues, for demanding and appropriating a proper supply of nourishment; and to the organs of elimination, to free the system from its waste products, which otherwise would gradually accumulate in the circulating fluid, interfere with the nourishment of the tissues, and impair their structure. This gradual failure of appetite instead of acting as a warning, as it ought to do, is often defeated of its purpose by the heedlessness of the individual so reminded, who, instead of trying to mitigate the evil by partaking of a diet more simple and more moderate, tries to excite a false one by dainty dishes and hot sauces, thus adding to instead of diminishing the danger. The blood becomes loaded with fat, the tissues naturally follow suit as they assimilate it in lieu of their proper pabulum, their vitality is lessened, and in place of musular fibre being produced, or tissue similar to their own structure, it is replaced by fat. And this change is encouraged by the want of exercise, for, as the require-

ment for muscular fibre diminishes, the strongest stimulus to its production is withdrawn. Thus degeneration commences, but, as is natural, the tissues at first object and struggle against this deterioration, and only gradually succumb; hence, at the beginning its progress is slow, but they by degrees accommodate themselves to these changes, and then its advance becomes more rapid. These exciting causes do not come into play until about middle age, which is another reason why the lesions due to degeneration do not, in the majority of cases, develope themselves until the patient is up in years. As to diet, it ought to be borne in mind that with the cessation of growth and diminution of exercise the body does not require so large a supply of nutriment as formerly. This in some cases should be more particularly remembered, as many, who having made a competence or fortune, give up business, and are in a more favourable condition for the occurrence of degeneration, unless they have some hobby or scientific pursuit to amuse or employ their time, and which will entail mental or bodily work. Hence the result we often see of men who have led hard working lives breaking rapidly down under an enforced state of idleness. The chief points, then, to be kept in remembrance as to diet are, that as we get past the prime of life we do not require so much food as formerly. This fact is of the more importance, as from the accompanying disinclination for exercise there is not the same amount of carbonaceous matter eliminated. Consequently it accumulates in the blood, and is deposited in certain tissues, destroying and replacing their normal tissue elements. The next essential element of health is, that the organs where the circulating fluid is prepared and elaborated be kept in perfect working order. To enter

upon the many different derangements and diseases of these organs would require a separate treatise, but sufficient for our purpose will it be to generalise their causes and enumerate them under the following heads:—

1*st*, Food, improper either in quantity or quality.

2*d*, Want of exercise; and

3*d*, Intemperance.

The first applies more particularly to too much food, and that of too rich a quality; although, probably, in some instances the other extreme may also act as a cause by so weakening the system as to induce degeneration. The first is, however, the more common of the two, and it must be borne in mind that it does not by any means entail present or immediate discomfort, for the stomach is a long-suffering organ, and may be abused for a considerable time before any symptoms of derangement manifest themselves. There is no doubt that at the present day indulgence in eating is carried further than is consistent with health. This is often seen when after dinner wine is felt to be necessary to assist and stimulate digestion, because the stomach has had more imposed upon it than it can conveniently digest, giving rise to feelings of repletion to which eating should never be indulged. This should be guarded against, as we believe it frequently induces a tendency to intemperance. Then comes the want of exercise to increase the danger, for if taken regularly it might modify these bad habits, or at least keep the evils resulting from them in temporary check; but, unfortunately, this very habit of over-indulgence brings with it the disinclination for exercise, and the consequent gradual accumulation of fat in the blood and in the tissues, which of itself is a mechanical impediment to exercise. The

third evil is intemperance in drink. It is already sufficiently well known and admitted as such without requiring further arguments here. It has been shown by Parkes, in his work on Hygiene, that the body in a state of health does not need alcohol in any form, that it supports fatigue and resists cold better without it, so that unless prescribed by a medical man it may do a great deal of harm. The derangements of the digestive system which it causes are the most persistent and incurable, destroying the appetite, then injuring the coats of the stomach, lowering the vitality of the system, and predisposing to disease of other organs, all of a degenerative type. It has also been proved that these changes take place earlier, advance to a greater extent, and occur much oftener in those who have led intemperate lives than in others—showing the prominent position it occupies as a cause of degeneration. The blood becomes loaded with abnormal and injurious matter, as alcohol interferes with elimination, and instead of the more elaborate muscular fibre being produced, fat, a substance lower in the organic scale, is substituted in its place. This, in a general way, shows the close connection all the functions have in maintaining the body in a perfect condition, and how injury of one organ or part influences others to their harm, and how the heart having, of all the organs of the body, most work to do, is the most exposed to the danger of its structure being affected by these deteriorating changes.

Secondly, We have said that a certain influence of the nervous system is imperative to a healthy condition of the body. We shall, therefore, consider now how any circumstance affecting it may predispose to degeneration.

Fever and many diseases make a great demand upon the nervous system, leaving the convalescent patient frequently in a most painful state, suffering from a train of symptoms termed nervous, and accompanied by a great waste of tissue, so that the heart in some instances is weakened to such a degree that fatal syncope ensues on the least exertion. In some cases, however, as in typhus, the cause is only in action for a limited period, and with careful nursing and nourishment the balance of health may soon be restored. It is not always thus, unfortunately, in such diseases as intemperance, syphilis, scrofula, and other exhausting affections, which continue through a longer period of time, and although more slowly, quite as surely undermine the nervous system. After indulgence in drink, that this system is unstrung is plainly evident in the shaking hand, the unsteady gait, and want of control generally over the voluntary muscles, which ultimately, in the confirmed drunkard, becomes persistent, a general tremor seeming to pervade his entire muscular system, frequently ending in a climax of nervous fever or delirium tremens. That this state of intemperance is accompanied by a lowered vitality is well known, and is manifested in the obstinacy with which wounds heal in those who are addicted to this vice, and the danger of sloughing which follows, as well as by the frequency with which degenerative changes are met with in their internal organs.

Syphilis also tends to accelerate these changes, although not so much in the present day as formerly, when the mercurial treatment was abused. Still, in the syphilitic cachexia, the pale face, emaciation, and occurrence of eruptions and unhealthy ulcerations, all manifest this impairment of the nervous system. Hence each of these diseases

is a strong exciting cause of degeneration, and all the more so when they exist in combination, as is often the case in soldiers, who, as a rule, do not lead the most moral lives, and in whom, perhaps, syphilis is more common than in any other class of the community. Again, in exhaustive diseases, as scrofula, chronic abscesses, disease of bone, or large ulcers, we frequently have degenerative changes occurring in internal organs, as waxy liver, spleen, kidneys, &c., showing the close relation between lowered vitality and degeneration of structure, and that a certain influence of the nervous system is necessary for the preservation of health.

In some cases of death from fatty heart, we find that the individual has been addicted to hard and continuous mental work, but, at the same time, has led a temperate life, though sedentary. In these cases the result is, no doubt, brought on by the nervous exhaustion due to the long-continued strain of the mental powers, which, combined latterly with want of exercise, has induced degeneration. It is in these cases, too, that the mischief is usually postponed for a long time. At last, however, the wasted nervous energy and insufficiency of counterbalancing bodily exercise tells, and with the impaired vitality consequent thereon, the tissues lose the power and stimulus to reconstruct themselves with their natural pabulum, and the result is a material less perfectly elaborated.

The third condition necessary for health is, that the part to be nourished be healthy. This as a rule will follow, provided the first two conditions are maintained, and is the natural result of their combined action. But if once a change of structure has taken place in any tissue or organ, it is very apt to remain a fixture, being, as it

were, adopted in time by the economy instead of the tissue it replaces, as is the case with cicatricial tissue, nature becoming reconciled to the change, and treating it as a lawful tenant. For perfect health, then, these three conditions must be present: a healthy state of the blood, a certain influence of the nervous system, and a proper state of the part to be nourished. Deviations from these conditions are liable to induce fatty degeneration, according to the degree in which they occur, by too great a quantity of fat-forming products being supplied to the blood, by their elimination being interfered with, or by a want of vital energy sufficient to elaborate the higher forms of tissue development.

As to the point of time when these lesions occur, we find that, in the intemperate and syphilitic, they supervene at the earliest period. And in these cases, there is no doubt that it is the nervous system which is first at fault, as these poisons act through it in the first instance.

The next class of cases is that in which degeneration occurs at a more advanced age. To it belong those who have been addicted to over-indulgence in food without taking a sufficiency of exercise. In them the nervous system is not primarily affected, but is only involved in the course of time. When the whole system is enfeebled, and in a morbid condition, then its progress is more speedy.

Another class is composed of those in whom it occurs at the most advanced period of life, who have led temperate lives, combined with great mental labour, as clergymen, statesmen, &c., whose nervous system has been impaired by the constant strain put upon it, and that, with the sedentary nature of their work, brings on degeneration. The time of the occurrence of degenera-

tion, therefore, depends on the injury received by the nervous system; so that perfection of development can only be attained by a perfect nervous system. The influence which it exercises upon development is readily seen when it is feeble, as in idiots. How stunted and deformed are they, with feeble muscular powers! It is also seen in the delicate children of the drunkard, and in the weak offspring of unhealthy parents, &c.; and as a fact, it is indisputable that degeneration is the result of impaired vitality.

From what we have said, it will be evident that treatment can be of little avail, owing to the difficulty of distinguishing the disease in its earlier stages. And from the nature of its progress, little can be done except in relieving symptoms. Knowing then our inability to check or cure its ravages, the more should our attention be directed to its prevention. By avoiding the causes we have mentioned, and paying attention to the general laws of Hygiene, being temperate in all things, is the only way of allowing nature to fulfil her destiny.

CHAPTER II.

DISEASES OF THE RESPIRATORY SYSTEM A CAUSE OF HEART DISEASE.

In medicine it is well recognised that for special training in any one particular branch of the profession, it is most important to know not only all in that one selected province, but that, to master it completely, a thorough knowledge must also be gained of the physiology and pathology of all the organs of the body. A surgeon, to be a proficient in his art, must also, to a certain extent, be a physician, as in judging of the advisability and propriety of performing an operation, he often requires to know the condition of internal organs. There may be some affection present in them which would render operative interference more or less useless, or perchance hasten death instead of saving life. So also in the case of the oculist. The connection between disease of the kidneys and some affections of the eye must be borne in mind, to distinguish between mere local lesions and those depending upon constitutional conditions. By none, perhaps, is this fact better appreciated than by the physician who makes diseases of the circulatory system his particular study. Well he knows that, from the intimate relation of the organs within the thorax both in an anatomical and physiological point of view, it is impossible to comprehend clearly the natural phenomena and the symptoms of morbid change in the heart and large blood-

vessels, unless he be equally well acquainted with the phenomena natural to the respiratory system, and with the changes which occur in them from disease and the symptoms thereby generated. Otherwise he will be exposed to endless fallacies. For to be able to detect and diagnose disease of an internal organ, it is necessary to know what changes in neighbouring organs may conceal or simulate the real malady, and lead to an erroneous conclusion. And so difficult is it sometimes, from the absence of distinct symptoms, to form an opinion, that we are obliged to be content with as probable an idea of the nature of the lesion as we can gain by the method of diagnosis by exclusion. Great effusion into one of the pleural sacs, or contraction of a cavity in the lung, by pushing or drawing the heart from its normal position, might lead to the idea of hypertrophy or aneurism. A case of emphysema, where the arched chest and dilated air-cells give a resonant note on percussing the cardiac region, might lead to the opposite conclusion, or where condensation of the lung substance has taken place in the immediate vicinity of the large blood-vessels, giving rise to dulness on percussion, an aneurismal tumour might be suspected. Instances might be multiplied, but these examples are sufficient, we think, to explain our meaning, and to show how grave mistakes might easily be committed through ignorance or carelessness. We thus see how important it is for the physician, who takes an interest in diseases of the circulatory system, at the same time to be thoroughly conversant with the diseases of the lungs; all the more so, when we know that diseases of the lungs can seriously injure the heart, and *vice versa.* Bearing in mind, then, these two facts: 1st, The benefit of studying the diseases of these two systems together;

and, 2d, That disease or derangement of one set of organs frequently induces grave disorders in the other, we shall readily perceive the important position that diseases of the lungs must occupy in a treatise on the etiology of heart disease.

Those pulmonary diseases which tend to induce alteration in the structure of the heart and affections of the valves are familiar to every physician, as bronchitis, emphysema, adhesion, dilatation of bronchi, cirrhosis of lung, &c., and *vice versa*, those affections of the lungs which are due to morbus cordis, as œdema, effusion, congestion, pulmonary apoplexy, &c. The enumeration of so many grave disorders which are liable to follow the disturbance of the balance of health between these two systems, the respiratory and circulatory, shows that their study in this relation is one fraught with much interest. When we examine the changes which take place in the heart in consequence of pulmonary disease, we perceive that there is a sameness in them as regards both the lesion and the part of the heart affected; for we generally find hypertrophy alone or accompanied by dilatation of the right heart, leading us correctly to infer that there is some obstruction to the venous circulation in the lungs, demanding increased work from the right side of the heart. The cause is simply a mechanical one. Chronic bronchitis and dilated bronchi, more especially when complicated with emphysema, present a serious opposition to the circulation of the venous blood in the lungs. This congestion aggravates the changes in the air-passages and vesicles, and so increases the danger. The bronchial tubes lose their elasticity, gradually enlarge in calibre, and assume different forms—globular, uniform, and nodulated—and the chronic inflammation of their mucous membrane in

creases the risk by interfering with the proper aëration of the blood. Then emphysema sets in, the air-cells become over-distended, and unable to regain their former dimensions. Changes take place in their structure, the network of capillaries surrounding their walls is obliterated, and part of the lung substance is placed *hors de combat.*

To what an extent this sometimes ensues is painfully evident, from the difficulty of breathing in many cases, amounting to orthopnœa. The change which takes place in the configuration of the chest, its gradually becoming round and barrel shaped, the hypertrophy of the muscles of the neck brought on by the exertion of raising the chest, all demonstrate what an extra amount of work must be thrown on the right side of the heart, to enable it to act successfully against this opposition. To do this, and partly in consequence of so doing, the muscular substance of the right side of the heart increases in bulk. This is nature's method of meeting the difficulty; and so far this hypertrophy of compensation cannot be considered a disease, but a wise prevention of danger. Hence, if hypertrophy remains within certain limits, there is nothing to fear from it alone. It is when accompanied by dilatation that mischief is apt to follow, as the walls of the ventricle expand, and more than counterbalance the beneficial effects of the hypertrophy. Dilatation is often due to degeneration of the muscular tissue, or to a continued strain having so weakened it that its elasticity is destroyed. It may also be due to long-continued congestion of the walls of the ventricle, owing to the obstructed pulmonary circulation having interfered with the nourishment of the heart.* "This interference in turn

* Walshe on Disease of the Heart.

theoretically lessens the power of resisting the excentric pressure of the blood on the part of the walls of the organ; hence dilatation of the cavities follows. And as a matter of observation, dilatation is found with tolerable frequency in cases of pressure by veins and intra-thoracic tumours and aneurisms. And further, the probabilities are, that long-continued stagnation will end in local exudation process of low type; and the effused fibrin, converted into indurations matter, must gravely impair the contractility of the infiltrated parts, and so in another form lay the ground-work of dilatation."

The left side of the heart may also become affected, and the valves are next involved, increasing the congestion, and also causing congestion of the kidneys, general anasarca, &c. More work is thus required from the enfeebled heart, and at the same time more obstacles are put in the way of its accomplishment, so that it gradually succumbs and ceases struggling against such overwhelming odds. Cirrhosis of the lung is also apt to cause hypertrophy of the right heart, especially if it involves much of the lung substance in its advanced stage; nodulated dilatation of the bronchi does the same. In cirrhosis the heart affection is not of so much importance as the primary disease, because, as a rule, it does not manifest itself until very late in the history of the case, and is only of importance clinically when dilatation supervenes.

Asthma, when uncomplicated, after some duration induces cyanæmia, and more rarely dilatation of the right side of the heart, with incompetency of the tricuspid valves; but when, in addition, bronchitis or emphysema are present, these secondary affections are of much more frequent occurrence.

The diseases of the lungs we have mentioned all tend

to produce the same lesions of the heart, modified only according to its condition when exposed to their injurious influence, whether it is quite healthy or already impaired in structure, because the more degeneration of its substance there is, the greater will be the risk of dilatation following upon hypertrophy, and the greater the danger to life.

In the majority of those cases in which lung affections are accompanied by alterations in the structure of the muscular substance of the heart, it is the dilatation that is to be feared; as hypertrophy alone is the safeguard of the heart, and enables it to overcome the obstacle to the circulation of the blood in the lungs.

To what, then, is the dilatation due?

Fortunately, it does not often occur in these cases without some amount of hypertrophy, nor is it by any means a frequent complication, so that it cannot always be due to the same cause as the hypertrophy, namely, the increased strain thrown upon the heart. If it were, we should expect to find them always present together. Aneurism of the aorta, when it has attained any considerable size, or continued for any length of time, almost invariably causes, to some extent, hypertrophy of the left ventricle. But it is not either necessarily, or even frequently at the same time dilated, though here also there must be a considerable strain thrown upon the left ventricle, as there is upon the right, when the pulmonary circulation is obstructed. Evidently, then, this extra pressure is not of itself sufficient to cause dilatation in all cases, and as there is no other external influence at work capable of doing it, we must look for the cause nearer home, in fact, in the substance of the heart itself.

Congestion of the veins of the heart, preventing it resisting the pressure of the blood, and exudation, interfering with the contractile power of the organ, are theoretical causes, but are not well borne out by pathological research. The heart, when it becomes dilated from the excentric pressure of the blood, must have its power of resistance diminished, must in reality be weak and feeble, and the only cause of this is either enervation or degeneration of its structure. The former seldom occurs alone, unless in the young, or when due to the poison of fever, &c. In the latter there is generally a combination of both.

In hearts affected with degeneration, dilatation is of frequent occurrence, the muscular substance becoming so thin and delicate as in many to cause death by rupture or fatal syncope. In those cases of hypertrophy, accompanied by dilatation, we find the heart flabby and soft, and on microscopic examination, presenting all the signs of fatty metamorphosis in different stages of advancement. Accordingly, whether dilatation occurs alone, or as a complication in other diseases of the heart, there is present, as the primary cause, fatty degeneration in the greater number of cases.

When the heart is in this condition, at least when the change of structure has advanced to a considerable extent in the muscular tissue, it is unfavourable to hypertrophy following, so that when both changes are present, the probability is that hypertrophy was first in possession of the field. After it comes degeneration, then dilatation.

This accounts for the history of many cases of hypertrophy of compensation—the patient enjoying tolerable comfort for a long time, but gradually signs of a dis-

turbed circulation show themselves as manifestations of the heart having become weak and dilated.

Hence pulmonary obstruction is not a direct cause of dilatation, but only the exciting one, and is not so much to blame as a cause of heart disease as is usually stated, the hypertrophy which it directly causes not being injurious, but the very reverse. For instance, suppose a case of chronic bronchitis and emphysema occurring in a person advanced in life, in whose heart there are some traces of fatty degeneration. The first result is hypertrophy, but with its gradual accession, the fatty transformation keeps pace, so that it is a struggle between the two which will hold out the longer. Time, however, which is unfavourable to hypertrophy, favours degeneration, so at first it is a compromise between the two, but ultimately degeneration gains the day.

The number of cases in which we find fatty metamorphosis engrafting itself, as it were, on hypertrophied hearts, leads us almost to imagine that it must have a special penchant for them, the soil, as it were, being congenial to its growth.

Probably this is on account of the increased formation of muscular tissue taking place there and acting as a spur to its development; since we find that, in organs whose functions are abnormally stimulated, and, consequently, where there is additional growth in structure taking place, there is a greater tendency for degeneration to supervene than in those whose function and growth are normal, so that hypertrophy places the heart in a condition favourable for its occurrence. For confirmation of this, we have the fact that the liver and kidneys of drunkards are especially prone to degeneration, also glandual structures which have become enlarged.

This connection, then, between heart disease and affections of the lungs, although not so direct as is frequently supposed, is still of sufficient importance to make us dread their occurrence. And, in our treatment of diseases of the respiratory system, we ought not only to combat them on account of their own intrinsic danger, but also as being extremely prone to set up mischief in the heart, especially if allowed to relapse into the chronic stage, or if care be not taken to guard against their recurrence.

Cases of bronchitis and emphysema are met with so frequently in this country, both in hospital and private practice, and are so easily diagnosed, that we are apt to treat them with too much of *sang froid*, considering how serious a complication heart disease is, and how liable it is to turn a simple case into a very grave one.

In examining the cases of bronchitis that come before us, we find that they present great differences in their course and termination. Some rapidly recover, others lapse into the chronic stage, or become complicated with emphysema and affection of the heart, and, according to the presence or absence of these complications, run a short or long course. Hence the importance for our treatment and prognosis to understand the influences at work in their production. Emphysema, when it occurs in early life, is in the great majority of cases hereditary, and the patients may live to old age provided bronchitis or heart disease does not supervene, but the cases which are of more special interest to us are those occurring in middle life and following bronchitis.

Chronic bronchitis is especially a disease of those in middle and old age, as in them bronchitis is more likely to degenerate into the chronic condition than in the young.

In some because the patient is apt to neglect it, or it may be, lacks the vitality to throw it off, but more frequently among the poorer classes, from their inability to lay up a sufficient length of time to get thoroughly rid of it, or, by making too little of it, getting gradually accustomed to the cough, and thinking it will go away in time. Occasionally, however, a fresh attack of cold is caught. The disease is slowly but surely strengthened in its stronghold, and gradually brings on those changes in the air-cells which will sooner or later lay the patient on the shelf, with little or no chance of recovery, but requiring to rest content with such relief as rest and the recumbent posture will afford. This should make us careful in our treatment of such cases, to make them completely well before dismissing them from our care, or to warn them of the risk they run if they neglect the disease. For what a number of cases do we constantly meet with, both in hospitals and workhouses, of men thus disabled, dragging out the term of a useless, and, to many, a painful existence, who might otherwise have been useful members of society.

These cases do not, however, all follow the same course; every case of chronic bronchitis, even of long standing, is not accompanied by well-marked emphysema and barrel-shaped chest, although there may be, and probably are, a few emphysematous air cells here and there in the lungs.

Again, every case of chronic bronchitis with emphysema is not accompanied by a hypertrophied or dilated heart, at least to such an extent as to cause troublesome symptoms, or to demand special treatment.

To account for this difference in the progress of these cases, it is clear that there must be either some peculiarity

in the accession of the disease, as regards its exciting cause, severity, and duration, or there must be some condition of the parts affected, which determine its future course, or, it may be, a combination of both. Naturally, in some the severity of the onset of the disease will influence to a certain extent its acuteness; that is, if in two given instances the same area of the air tubes is affected, and their condition is the same. But what strikes us most is, that in one the disease will run its regular course, through the acute and chronic stages, and leave the patient as well as ever, with the exception, perhaps, of being more liable to a second attack; while in another of apparently no greater severity, the chronic stage cannot be got quit of, emphysema gradually supervenes, and the patient goes on from bad to worse. This we often see. So that the cause of the difference in the progress of these two cases must be looked for, not in their exciting one, but in the condition of the structures affected by the inflammation. And it is here we think the true danger lies in the majority of cases, although we must allow that delicacy of constitution or hereditary taint, &c., will in some equally produce this unfavourable result.

Let us now take those in whom there seems to be some morbid condition of the air-passages or vesicles, which renders the attack so formidable, and examine them and see whether there are any points in common which might shed some light on the subject.

The most of such cases occur at or after middle age.—We must here except those occurring in the young, due to hereditary transmission,—when we also notice that degenerative changes in the arterial system and other organs are more prone to commence. In them we also observe that these changes have not only commenced,

but, as a rule, are already in many cases advanced and well marked, as seen in the arcus senilis, the tortuous arteries, &c., showing the presence of degeneration. We also frequently find in some, traces of syphilis and mercurialism, or old cicatrices, and in others ravages of the disease are still present; while in others we have the history of it, and perhaps in addition the confession of their having led intemperate lives,—conditions all of which we know to be strong predisposing and exciting causes of fatty degeneration of the tissues. This is the ordinary history of the worst and most intractable forms of the disease, and of those in which emphysema and heart disease usually supervene.

This may be a coincidence, but we think it too strong a one to be that alone. In fatty degeneration the original tissue is either replaced by fatty granules, or by the addition of fat, and is so smothered that it loses its consistence, and is rendered as useless as fat itself. When this change affects the arterial system, it commences in the connective tissue composing the innermost layer of the internal coat, which is afterwards frequently converted into calcareous matter. This change is liable to take place in nearly all the tissues and organs. We have it in the liver, heart, kidneys, spleen, &c. We also find it in the trachea, and in the walls of the air-cells. Rainey was the first to point out that oil was discoverable in the walls of the air-cells in cases of emphysema, and to demonstrate the fact.

Here we have a chain of evidence very strong. We have seen that fatty degeneration of the air tubes and cells does occur in bronchitis and emphysema, and that in the majority of the cases in which the heart is affected with dilatation, we have abundant signs that this degenera-

tive process has taken place, and is still going on, and, from the history of these patients, they are just the cases in which we should expect it. Hence we have strong presumptive evidence, that there is a connection of cause and effect between fatty degeneration and the above-mentioned cases of emphysema of the lungs. This is borne out all the more clearly when we come to look at the circumstantial evidence.

First, We meet with many cases of chronic bronchitis in the old, which have lasted for some time, and which, when we watch their further progress, continue simple cases of bronchitis, with, perhaps, only an amount of emphysema hardly distinguishable. In them we find few or no signs of degeneration, and that they have not been exposed to the causes most likely to induce such a morbid process.

Second, In cases of bronchitis and emphysema, in which the heart is affected, there are signs of the presence of degeneration, and as it has an especial affinity for this organ, it is more than probable that we shall find degeneration going on in these cases, when morbus cordis is an accompaniment. We don't forget that emphysema will of itself affect the heart, but the change is in the most of these cases a beneficial one, of compensation, and does not cause any interference with its function, but rather prevents other serious changes taking place, until very late in the disease, while in the other cases, the heart is involved at a much earlier period, and manifests its derangement sooner than it would do were it in a perfectly healthy condition. For we can easily understand how, if a strain were put upon a heart with any degeneration present in its muscular fibre, or with any tendency to it, instead of healthy hypertrophy resulting,

we should have dilatation in excess, and with it its attendant evils. This, we think, is the reason that in these cases, which go on so rapidly from bad to worse, the heart is implicated early in its history, and that in the majority the heart disease is due, not so much to the emphysema, as to the degeneration, which is probably the cause of both,—emphysema being simply the exciting one, by putting a severe and continuous strain on an organ already impaired, and working under disadvantageous circumstances.

This theory of the cause of emphysema explains also the differences which we so often see in these cases: why one remains a case of chronic bronchitis, why another may only have a slight trace of emphysema, and why others may be complicated with it from the commencement of the disease,—the air cells being in a condition which prevents them easily regaining their elasticity when once over distended, or prevents them regaining it at all, owing to the elastic tissue of their walls being replaced by fat.

From this we see that the danger to the heart from the above-mentioned disease of the lungs is comparatively trifling, unless where the cause has been long in operation, or when it is hereditary, owing to the accommodating power of the heart. But if the heart is not sound, and is the least tainted with degeneration, then the risk is very great, only being another proof of the innumerable evils that this process entails upon the circulatory system.

There are several other diseases of the lungs which are said to give rise to heart disease occasionally, as cancer, phthisis, contraction of the pleura, &c.

The danger to the heart from cancer is not its implicating the lungs, but from the general tendency it has

when so situated to involve the mediastinum, or even the substance of the heart itself, where by pressure or otherwise it may seriously interfere with its action and nourishment, as in the case we have related in the chapter on Angina pectoris.

Cases of phthisis sometimes suddenly terminate fatally from failure of the heart's action. In them, if the substance of the heart presents traces of degeneration, it is not due to the presence of tubercle in the lungs, but to the constitutional condition bringing about an altered state of the blood, which is insufficient for the proper nourishment of the tissues. Consequently, like the local lesion in the lungs or in any other organ, it is simply a manifestation of the tubercular diathesis, and both are results of the same cause.

This fatty diathesis is common to many diseases, which seem to have many points of similarity between them, as phthisis, syphilis, Bright's disease, &c. In all of these have we degeneration taking place in different organs; the one disease, to a certain extent, predisposing to the other, so that frequently they combine in the same unfortunate individual.

Pleuritic effusion, or the subsequent contraction, may alter the position, and interfere with the action of the heart, by pushing it to one side or the other. In one or two cases mentioned by Walshe it was, in all probability, the cause of cardiac murmurs, either by pressure upon the aorta, or by it being slightly twisted. But these cases are rather curious than of much practical importance, as treatment in them would be of little avail.

These, then, are the principal diseases of the lungs, which we find so frequently accompanied by some affection of the heart, as hypertrophy, dilatation, or valvular

incompetency, any one of which may occur alone, though more usually hypertrophy takes place first, and then dilatation, followed by valvular incompetency, so that the most aggravated cases are a combination of all three. And as we have seen that degeneration is at the root of the evil, it naturally follows that the further advanced this process is, the more speedily will those changes result and hasten the fatal termination.

From the frequency of the occurrence of these cardiac lesions in diseases of the respiratory organs, they have usually been considered as occasioned by them, and thus attributed to a cause the power of which has been overrated. In many instances, as we have shown, they have no connection of cause and effect, their joint presence being simply a coincidence. Heart affections occur in the course of many diseases, or occupy the ground before them, yet we are not entitled to say that the one is the cause of the other. Dilatation and degeneration of the heart are thus only grave complications, due to the same morbid process as emphysema is in some patients, because healthy muscular tissues always increases in bulk and becomes firmer in texture with exercise, so that if in the first instance the heart is healthy, dilatation cannot ensue, but it may, with the advance of time, when degeneration has begun and deprived the tissue of its elasticity. In that case the disease of the lungs cannot be justly accused of its occurrence. The other two affections of the heart attributed to disease of the lungs, are hypertrophy and valvular incompetency, and having shown the harmlessness of hypertrophy alone, the danger must either be due to the valvular lesion, or to the presence of some complication. When the valves become unable to perform their function properly, and permit regurgitation, it

is not due to the hypertrophy, but to degeneration of the heart's muscular tissue, which gives rise to dilatation and insufficiency of the valves; as in simple hypertrophy, where the ventricles act with increased power, there is no tendency of the valves to allow regurgitation to take place, since they close the auriculo-ventricular openings the more completely the stronger are the ventricular contractions. But occasionally we do find simple hypertrophy in lung affections accompanied by valvular incompetency. These, however, are the exceptions, and are due to valvular disease of long standing, from some old endocarditis, which has remained latent until disturbance of the circulation has been brought on by some pulmonary disorder, leading to a wrong conclusion. Hence, these diseases of the lungs cannot be blamed for directly causing heart disease, although they may be the exciting cause, or may severely aggravate it, or fan smouldering mischief into a deadly flame.

It is not, however, always necessary that there should be some one of these morbid conditions we have described affecting the lungs for the heart to be implicated. From the intimate sympathy in action between the respiratory and circulatory systems, it is evident that if the balance of health between them is disturbed, embarrassment of the circulation must ensue. And this, if continued for any length of time, or even if frequently repeated, exposes the heart to serious danger. In violent exercise there is a great strain put upon the lungs, and the rapidity of the circulation is greatly accelerated. Consequently the heart has more work to do, and if this strain is long continued, or frequently repeated, hypertrophy takes place; or, if the heart is weak, it may be paralysed, and syncope, or a fatal attack of angina pectoris ensue. And as in some

degree we hold these causes under our control, so, according to our knowledge of their power, we may prevent or inflict serious injury on the heart, and so much the more important is it for us to study carefully their action.

We repeat, then, that there is far more danger to the heart in temporary disturbance or strain of the pulmonary circulation from violent exercise, than there is from any disease of the lung substance or air passages. When the flow of blood in the lungs is quickened, the heart is compelled to act with more power; and to do so successfully it must, if the strain be long, or of frequent occurrence, take on more muscular tissue, as we have seen it does in some diseases of the lungs, and thus hypertrophy commences. At this stage of its progress it often warns us of its approach. There is not at first a sufficient amount of hypertrophy to enable the heart to bear its increased burden without showing symptoms of distress, as palpitation and irregular action; but if these are unheeded, they gradually cease with the advance of the hypertrophy, and then the danger commences.

In emphysema, chronic bronchitis, &c., the hypertrophy is not a disease, but a wise precaution of nature; and as the lung affections are unfortunately too often incurable, so the need of the hypertrophy is constant. But in the case of the temporary strain put upon the pulmonary organs, the requirement for increased work from the heart is only temporary; but, unfortunately, hypertrophy cannot be put off and on at a moment's notice, hence it remains stationary, or goes on increasing, according to the frequency and power of the stimulus. And when that stimulus is not in operation, the heart, owing to the increased development of its muscular substance, continues working harder than necessary,

while the lungs are not in an equally active condition. More blood is thrown into them than they can circulate, congestion takes place, or pulmonary apoplexy, and even sometimes cerebral hæmorrhage, phthisis also may be excited; hence we see that in these cases the danger is no light one which is apt to follow disturbance of the harmony of action of the respiratory and circulatory systems. When after exercise palpitation remains for some time, and is apt to recur, or the action of the heart is irregular, we should be advised that it has been carried beyond the bounds of prudence and safety, and ought to be moderated. Otherwise it may end in hypertrophy, which in this instance is not one of compensation, but a disease fraught with danger to life.

At the present day, when athletics are receiving so much attention in our public schools and universities, and many continue them in later years by joining alpine, cricket, and rowing clubs, &c., to keep themselves in condition, or as a healthy way of taking a holiday after a session's hard work, it has become better understood that it is false economy to overwork the mental faculties and neglect the body.

But every now and then our comfort is disturbed by hearing about the danger of some of these forms of exercise on the lungs and heart, and we begin to fear that all along we have been in the wrong, and that lucky we must be if we have escaped as yet. Let us therefore examine carefully, and see how the heart could be thus influenced injuriously, and if it is exposed to as much danger as many suppose.

What takes place during exercise? There is a greater expenditure of force and heat than usual, and consequently there is increased wear and tear of the tissues,

and a greater demand for nourishment. Respiration is more frequent, the heart beats with increased rapidity, as the blood has to receive more oxygen and give off more carbon. Provided the gear is all in perfect working order, everything goes on smoothly and without hindrance. The muscular fibres of the heart are strengthened, and a higher tone is given to the nervous system by exercise in moderation, and regulated according to the common rules of health.

Very few, however, are in such good condition as to be able for much or great exertion at any time without danger of injuring themselves, unless they have previously undergone a careful system of training. Comparatively seldom do we exert our lungs to their full capacity, and to do this suddenly, or for any length of time, might cause serious embarrassment of the circulation, and bring on congestion from their inability to receive and circulate the increased supply of blood, their elasticity having been impaired by want of use, in fact being stiff and unyielding, and requiring gentle and gradual pressure to make them expand, as a sudden strain might burst their walls. This is the way we sometimes find emphysema commences, being, as it were, of a traumatic nature. Many other evils happen in the same manner from mere thoughtlessness, and bring exercise into evil repute. To call suddenly upon the heart and lungs to exert themselves to the uttermost without their having first undergone a gradual series of trials, each surpassing the previous one in severity, is just as foolish, and apt to be attended with as bad results, as if we were trying to drive an engine which had not been recently in use, and wasn't oiled, at full speed.

This is especially seen in old people, when, in making

a great effort, the heart becomes occasionally paralysed, and death ensues; or when an old man, in a sudden frolic, trying to dance and jump, ruptures his tendo-achilles. Accordingly, unless in the case of school-boys —who are to a certain extent in a state of perpetual training—all exercise should be at first taken moderately, and, if gradually increased, the heart and lungs will ultimately be in such a condition as to be able to bear almost any strain without injury. But to attain this happy result, we must be sure that there are no disqualifications in these organs themselves, or hindrances to their acting properly; for instance, there must be no impediment to the free expansion of the lungs, either by dress compressing the chest externally, or from any inherent weakness of the lungs rendering such expansion dangerous.

The advantage of the chest being free is now generally appreciated, although perhaps this has not been the case in the army so much as could be wished. Mr Myers has shown in his essay that constriction of the chest by the accoutrements is a part cause of hypertrophy of the heart and irregularity in its action, by impeding the free expansion of the lungs, and throwing an increased strain upon the heart to overcome it. Then there must be no delicacy of the lungs themselves, as the tendency to the deposit of tubercle or its presence, as in these cases not only is it dangerous from the risk of a chill being caught when overheated, but there is the risk of it acting as a stimulus or exciting cause of the disease, by irritating them in the first place, and, secondly, by the exhaustion which exercise entails. So that it would be the wisest course, in many cases, for parents and guardians to get the advice of their medical attendant as to the best form of exercise suitable

for their children or wards when any constitutional delicacy is suspected.

Exercise, to be of much use, should be varied, so as to bring as much as possible the different sets of muscles into play, and strengthen equally the whole body, and not to make a man all arms or legs, as the case may be. Equally necessary is it that there should be nothing in the heart that could render it dangerous, and more especially should those who have had rheumatic fever, or who have the rheumatic diathesis, be careful, as the risk of the occurrence of even secondary affection of the heart renders a chill in those so predisposed almost as dangerous as in the phthisical.

If these precautions were taken, we are confident that we should have fewer instances of bad effects from exercise, fewer cases of organic and functional diseases of the heart, and less dread amongst the nervous and timid heads of families, who are so apt to over-estimate any danger, the more so if they don't exactly understand what it is, and are only impressed with vague fears or rash statements.

CHAPTER III.

RHEUMATISM AND GOUT.

In examining cases of heart disease, there are two points which at the very outset always obtrude themselves for investigation. The first is of special importance in the young, Has the patient suffered from rheumatic fever or rheumatism? and the second in those more advanced in years, Is there any sign of degeneration present? These two questions, so frequently answered in the affirmative, evidently indicate that these lesions play an important part in the production of heart disease. But if, on inquiry, we cannot lay the blame to either of the above-mentioned causes, we straightway direct our attention to others, as gout, Bright's disease, sudden strains, or disease of the respiratory system. And under one or other of these we can nearly always put the case, if one of organic disease.

Let us not forget that by this method we are exposed to an apparent fallacy, for we sometimes meet with cases of organic disease of the heart in the young, in whom there is no history of rheumatism! But if we inquire more carefully into these cases, we can almost always discover that the rheumatic diathesis is present, and although it may not have shown itself in any direct accession of rheumatic fever, still betrays itself by other reliable signs,—the occasional rheumatic pain or erythema, or, the soft perspiring skin, the frequent deposit of urates, attacks of acidity of

the stomach, &c., all showing that there the latent power for evil lies.

The share that rheumatism has in the production of heart disease may be roughly estimated from the following: Bouillaud gives 86 per cent. as the proportion in which the heart was affected among those who came under his care suffering from acute rheumatism; Dr Barclay, in his observations in St George's Hospital, gives a percentage of 44; Dr Fuller gives a higher percentage. Thus, at the lowest computation, it was the cause in nearly 50 per cent. of the cases—an enormous proportion. Dr Dickinson, in 1862, found the percentage much reduced since the employment of alkaline treatment.

We shall study rheumatism and gout together here, allowing their distinctive qualities as separate affections, but as still having some points of resemblance, both being due to an altered condition of the blood, which causes lesions of the circulatory system.

We cannot, of course, enter upon an elaborate pathological essay on the causes of rheumatism and gout, as in the present state of our knowledge it might lead us a profitless journey among vague theories and speculations. Sufficient will it be for our purpose to use as data only recognised facts, and to confine ourselves as strictly as possible to them alone.

1. Rheumatism and gout are hereditary. Rheumatism affects the sexes impartially, while gout, as a rule, is almost exclusively attached to the male sex.

2. Rheumatism has most of its victims in early life, while gout generally attends upon riper years.

3. In both the blood is altered in its composition, containing abnormal ingredients.

4. The affections of the heart which occur in the

rheumatic differ from those we meet with in the gouty. In the former they are of an inflammatory, in the latter of a degenerative type.

5. We find heart disease in the rheumatic at an earlier age than in the gouty.

6. Certain tissues are more liable than others to the local manifestations of these diseases.

In rheumatic fever there is an excess of acid in the blood, shown by the deposit of lithates and lactates in the secretion from the kidneys, and in the acidity of the perspiration. There is also a large increase in the fibrine more than in any other acute inflammation. This condition of the blood is due to some abnormal metamorphosis; and this tendency of the system is termed the rheumatic diathesis.

This poisoned condition of the blood is manifested in the duration and frequent recurrence of the paroxysms, in the symmetrical development of the local symptoms, and in the constancy of premonitory fever, or of fever associated with the progressive development of the disease, with a large number of local symptoms, and lesions of internal organs, occurring simultaneously.—*Aitken.*

If we examine the local manifestations of this disease, we find that it specially affects certain structures, which are, according to Aitken, the ligaments, fasciæ, tendons, bursæ, and serous membranes of the heart and brain. But the joints and the surrounding structures are the parts most commonly implicated.

In this disease, then, there are two points to be observed: —that the blood is in an altered condition, containing an excessive amount of an acid, and of fibrine; and that certain tissues of somewhat similar structure seem to be

especially liable for selection as the seat of its local manifestations.

These two facts appear to us to indicate some connection of cause and effect between them, why these structures should alone suffer. The blood in rheumatic fever, on account of its containing an abnormal constituent in the shape of an acid, probably lactic, and a larger quantity of fibrine than in health, is rendered denser and more coagulable,—a condition in which it is circulated with difficulty, and requires more power to propel it, tending to make it more liable to stagnate, and permit of exudation in the smaller capillaries, in other words, to induce local inflammations.

This, however, is prevented in the tissues, except in the ones we have mentioned, either on account of the quickened circulation due to the fever, or because the capillaries yield, and by their elasticity counterbalance the greater density of the fluid.

What is there, then, in these unfortunate selected structures which prevents them doing likewise ?

If we examine them, we find that they are composed of tissues more compact and less yielding than many others, so that the overloaded capillaries are placed in an unfavourable position, because, from the nature of the tissues in which they are imbedded, they are not permitted sufficient compensatory expansion, rendering the occurrence of exudation easier and more frequent in these textures than in others. According to the nature of the tissues where the exudation takes place, is the stage which the inflammatory process reaches, as an effusion when it affects serous membranes or joints, plastic changes in the smaller joints where there is insufficient space for the reception of fluid, ending in thickened struc-

tures and deformed joints; but the local manifestations of rheumatism being unfortunately so frequent, although various, it is needless to mention others, if we keep in mind that the nature and result of the local inflammations depend upon the structure of the parts attacked, and that their function in the economy regulates the danger there is to life. For instance, a rheumatic affection of one of the smaller joints is not so serious as if the knee-joint were affected; and rheumatic inflammation of the knee-joint is comparatively trifling compared to pericarditis or endocarditis.

This selection of particular textures for the manifestation of the local lesions in rheumatism has been noticed already by Dr Fuller, who says, "that the textures most commonly implicated are all examples of the albuminous and gelatinous tissues, from the decomposition of which, in the wear and tear of the body, are formed those secondary organic compounds, the lithic and lactic acids, with which gout and rheumatism are intimately connected." Dr Simon attributed it to the increase of fibrin.

Dr Fuller's observation is correct, but his theory by which he accounts for it is untenable.

Dr Simon, by his investigations, has demonstrated the fibrinous condition of the blood; and we have tried to show that the selection of certain tissues as the seat of the local inflammation is due to their structure. For we know that when congestion once takes place in a part, if continued for a sufficient length of time, it will go through the further stages of inflammation, and the unyielding nature of the fibrous and fibro-serous textures favours the occurrence of congestion by pressure.

The many instances in which this causes and increases inflammation are well known, as in the occurrence of bed

sores, the rapid extension of inflammation affecting parts bound down by fasciæ, &c., and the immediate relief when such pressure is removed. Hence the altered condition of the blood is the cause of the group of symptoms which we term rheumatic; and its increased density, and the structure of certain tissues, predispose them to be affected by local inflammations during the course of the disease. The diseases to which the heart is liable from rheumatism are—

1. Pericarditis and endocarditis.
2. Inflammation of the substance of the heart.
3. Affections of the valves, ending in the formation of fibrinous vegetation and subsequent degeneration of the valves.

Dr Latham and Dr Walton hold, that pericarditis is more often found in severe cases than in mild, while Dr Fuller states the very opposite to be the result of his experience. This very discrepancy shows that there is little connection between the intensity of the fever and the frequency of the occurrence of heart complication, as in some of the most severe attacks the heart remains unaffected, while in others the heart affection is the only manifestation of the disease, so that, according to the nature of the cases coming under the notice of a physician, he might either agree with Dr Walton or Dr Fuller. The truth, in all probability, lies between these two extreme opinions.

The cardiac inflammation is sometimes primary to the articular, and *vice versa;* but the cause in both instances is the same, viz., the altered condition of the blood, and not a metastasis as was at one time supposed.

To this condition of the blood in rheumatism that in gout is somewhat analogous, for in it the blood is loaded

with urate of soda which the circulating fluid holds in suspension easily enough in the larger vessels, but as soon as it reaches parts where, by their remoteness from the centre of circulation, the force of the current is necessarily at its feeblest and the size of the capillaries at their minimum, and placed in textures that don't allow of their coats yielding, then from stagnation of the circulation, exudation, or rupture of the smaller vessels follows. Hence the gradual deposit of urate of soda in the neighbourhood of the joints at the commencement of the disease, especially of those articulations the farthest removed from the centre of circulation, as the toes and fingers, constituting an attack of the gout.

The difference between the rheumatic and gouty attack is, that in the former the fever is the primary affection, while in the latter it is as a rule secondary to the local one when it does happen.

In the majority of cases the local inflammation of the joints is most severe in the earlier attacks of gout, and seems to moderate in intensity with the deposit of the urate of soda, the vessels in this manner appearing to be relieved, and the severity of the attack mitigated.

Although the blood in gout resembles that in rheumatism by the presence of an abnormal constituent, it does not resemble it by being in addition overloaded with fibrine. Hence the reason of the difference in their local complications. The blood in rheumatism, from its greater density and from the quickened circulation, renders the occurrence of congestion and inflammation more frequent than in gout, and affects tissues which are not obnoxious to gout. This explains the liability of the pericardium and the fibrinous structure of the valves of the heart to be affected in rheumatism.

There is another law which we must notice here, viz, that any organ when subjected to an extra strain, especially if it is continued for any length of time, is more liable to have morbid action set up in it than when working at its normal rate. This is another reason why the heart is so liable to be attacked in acute rheumatism, especially those tissues of it which from their structure we have shown to be most obnoxious to the change in the condition of the blood.

In Bright's disease, where the heart is so frequently affected, the hypertrophy was attributed by Dr Bright to the stagnation of the blood in the capillaries, or rather to the increased difficulty of propelling it through them when loaded with urea, which offered a mechanical obstruction to its passage, and called upon the heart for increased work to overcome it. This if continued for some time, gradually led to changes in the structure of the heart, first of the nature of compensation, then, if going beyond this, to the valves becoming incompetent, and serious embarrassment of the circulation.

This theory of the causation of hypertrophy in Bright's disease is correct so far, although we think that there are also other influences at work in its production, all of which act by mechanically impeding the circulation.*

In rheumatism and gout this is done to a certain extent,—in rheumatism only during an attack, when the blood is in an altered condition, and loaded with abnormal products culminating in a regular accession of constitutional symptoms. The pyrexia also acts injuriously on the heart, being another stimulus to overwork, and rendering it more prone to inflammatory changes.

* See chapter on *Bright's Disease.*

Thus in rheumatism the heart is exposed to the same malign influence as in Bright's disease; but only for a limited time, namely, during the acute accessions of the disease; so that it escapes hypertrophy, as in the intervals it has time to recover itself and regain its former tone.

In gout, however, it is otherwise, as the blood, not only during an attack, but also in the interval, retains its abnormal constituents; accordingly, as in Bright's disease, the heart is liable to change of structure or hypertrophy, while in rheumatism the forms of heart complication are always of an inflammatory type.

In gout the heart complications are due to degeneration of structure, either alone or accompanied by hypertrophy. Very rarely does hypertrophy occur by itself.

In rheumatism the heart complications are always of an inflammatory type, or the result of inflammation.

Rheumatism attacks the young most frequently, while gout is more a disease of advanced years, unless it be hereditary, when it has a tendency to occur at an earlier period than in others. From this it necessarily follows that the heart complications of rheumatism occur at an earlier age than in gout. Though there is another reason for this; namely, that most of the cardiac complications in gout are due to degeneration, which is peculiar to advanced age as a rule.

Rheumatism affects the sexes impartially, while gout is almost exclusively confined to the male sex. This partiality of gout is, no doubt, due to the fact that the male sex indulge to a greater degree than women in articles of food and drink that predispose to the attacks. Still, as they are both hereditary diseases, gout sometimes affects the female sex, only in them, in all probability, it lies

dormant, and is not called into action on account of their quiet and temperate mode of life.

The fact that gout occurs at a later period of life than rheumatism, shows that the changes which take place in the blood in these diseases must require different degrees of time to complete and render them capable of inducing the symptoms which we attribute to the one or the other.

Rheumatism, however, may attack very young children, which gout never does. In these instances, without doubt, the blood has not been changed during the life of the child, but has been transmitted to it in this state by its parents, whereas, in gout, the hereditary predisposition is not nearly so strong. If it were, we should meet with it more frequently in the young and in women. Another argument for believing the hereditary predisposition of gout to be weak, is, that when it does occur, the individual has frequently followed the habits of his parents, which habits are of themselves sufficient in many to induce the disease. But, naturally, it is much pleasanter to attach the blame to others than to ourselves.

This greater tendency of the hereditary transmission of rheumatism than gout seems, then, to account for the earlier occurrence of the one, as we know, that in the transmission of disease from parents to children, the children who have inherited a liability to disease are more frequently affected, and at an earlier period than those in whom this predisposition is slight or altogether absent.

In works on gout we read a great deal about metastasis or flying gout, that is, gout disappearing from one part and attacking the heart, but now we know that, properly speaking, this never takes place—that the materies morbi never deserts one structure to excite change in another, but that all the blood being in the same altered condi-

tion renders those parts which from structure, position, or function, are most prone to it, the most likely to be attacked. And there is no reason why, although it may manifest itself first in the toe, it should not attack some other part without being called a metastasis.

We find that two inflammations cannot both progress well when near each other. The greater generally submerges the less on the principle of counter-irritation, and the minor inflammation either remains in abeyance, or gradual resolution takes place. But this is no metastasis.

What I principally wish to draw attention to are the frequently reported cases of the metastasis of gout to internal organs from external parts, or, as we have shown metastasis to be a wrong word, we shall substitute the expression of gout attacking an internal organ after having distinctly manifested itself externally.

These cases, we believe, are far fewer than usually stated, for, no doubt, many take refuge under this confusion to conceal their ignorance, or to satisfy their undecided opinion. Still they do occur. For instance, during an attack of the gout, the patient may be seized with a paroxysm of angina pectoris. And as the heart, if affected in gout, is usually in a state of degeneration, especially fatty, and, therefore, weak, these attacks of angina are not uncommon, especially as they are often brought on by mental or bodily excitement. Instead of being due to a metastasis of the gout, they are simply the result of partial paralysis occurring in a heart weakened by fatty degeneration of its substance, and which state can, without doubt, be induced by the gouty diathesis. This we shall enter upon more fully when we treat of angina pectoris.

Angina pectoris, however, is not the only cardiac affec-

tion we meet with in the gouty. We may have dilatation or hypertrophy in different stages, either alone or combined, degeneration of the valves or of the aorta, terminating in incompetency or dilatation, &c. But these affections all depend upon change of structure, determined according to the position and function of the parts affected, so that in speaking of the cause of one, we include all, and do not require to specify them more particularly. For our inquiries are directed more especially to the causation of heart disease in general, and not to the mere variations of the power in different parts.

Having thus traced what we believe to be the connection between gout and rheumatism, and the forms of heart disease peculiar to each, we have now to consider the causes of these diseases themselves, as it is only by ascertaining these, that we can reach the root of the evil.

Notwithstanding the many careful experiments and investigations which have been made to this end, we have not as yet solved the difficulty. Still, sufficient evidence has been adduced to show us where the evil lies, although not sufficient to enable us exactly to say what is the precise change that takes place in the blood. That a change does take place, and the result of it we know. And from our knowledge of physiology, we can affirm with certainty that it is due to mal-assimilation, which would not occur if all the digestive functions were in a healthy condition, a fact which shows the necessity of paying these careful attention, the stomach being an all-powerful organ either for good or evil.

Rheumatism we know to be hereditary, and gout also, though in a much smaller degree. This is, in all probability, due to the long continuance of the morbid condition of the blood in the parent, causing that condition to become,

as it were, naturalised, in the individual, and to reproduce itself in a modified manner, like cicatricial tissue. Still this hereditary tendency would soon die a natural death, if its possessors were careful not to foster it, by avoiding all exciting causes. In gout, then, the blood, owing to mal-assimilation, is in a depraved condition, containing abnormal products injurious to health, and deficient in some of the constituents necessary for maintaining the tissues, and building them up to the normal standard. Thus a faulty nutrition or degeneration ensues. The tissues are replaced by a substance lower in the organic scale than the normal materials, and that change affecting the heart, gives rise to those diseases of that organ which we have already enumerated. This appears to us to be the connection between heart disease and gout. The first cause of both is mal-assimilation, then more directly the altered condition of the blood, so that, strictly speaking, gout is not the cause of heart disease, any more than heart disease is the cause of gout, both resulting from the same cause, and being manifestations in different parts of this morbid condition of the blood.

Treatment of Gout.—First, of those who possess a tendency either to gout or rheumatism. They should be extremely careful as regards their diet, living chiefly on plain and easily digested articles of food, as mutton, chicken, beef, and white fish, milk, &c., but carefully avoiding rich dishes and hot sauces, or sweet wines. Exercise should be taken regularly and moderately, and exposure to damp should be avoided. Regular hours should be kept, and all excitement, bodily or mental, guarded against. During an attack, the regular remedies should be employed. But these are so numerous and various, and have met with such different success in

different practitioners' hands, that each one must judge for himself, according to the case and his experience, what line of treatment he should follow.

As regards rheumatism, during an acute attack we depend greatly upon alkalies, on the theory of their neutralising the acid in the blood, and certainly this method seems to give the best results of any in practice. The local inflammations are most successfully treated by circular blisters. But we think that a better plan still is, counter-irritation, applied on the principle of Mr Fourneaux Jordan's plan, by means of blistering fluid and iodine liniment, painted in zones round the inflamed joints, and over the next vascular area. This treatment has been especially successful in the hands of its author. The only difficulty is in the case of the heart. But even there we think it might be useful, not applied as at present over the joints, only when inflammatory action has commenced, but at the very outset of the attack. When we consider the gravity of the lesion we are treating, we do not think it could be objected to as unnecessary or cruel, if used in every case as a prophylactic. The method we should recommend is this,—that as soon as we are convinced it is a case of rheumatic fever, all the front of the mediastinum, a space corresponding to the superficies of the heart beneath, should be painted with the iodine liniment, that this should be renewed every second day, so as to keep up the counter-irritation; and that as soon as we begin to suspect the presence of peri or endocarditis, a strip should be painted with acetum lyttæ, over each axillary artery, a procedure which, I think, we should be justified in adopting, after the happy results it has achieved in the hands of Dr Jordan when applied to inflammation in other parts.

CHAPTER IV.

BRIGHT'S DISEASE.

Diseases of the kidney have of late years received special attention from pathologists and physicians, first on account of the number of cases met with in practice, and their danger to life; and, second, because of the serious lesions of other organs which are apt to ensue in the course of this disease, and to prolong recovery or hasten the fatal termination.

"It appears from the researches of a late author, Dr Mather of Belfast, extending through a period of twelve years, and over 2000 cases of all diseases except fever, that one-sixth at least is formed of cases of dropsy, and that of these one half prove fatal. But from the inquiries of Dr Wells, it may be deduced that fifty-five per cent. of all dropsies are connected with diseased kidneys; my own observations would raise the amount to fully three-fourths of the whole; and, according to the experience of Dr Bright, the ratio is even higher." *

The complications connected with degeneration of the kidneys are many, and chief among them are diseases of the heart and circulatory system, diseases of the liver, inflammation of the lung substance and pleuræ, inflammation of the peritoneum, affections of the stomach and intestines, rheumatism, dropsy, apoplexy, coma, &c.

This long list of complications, one or more of which

* Christison on "Granular Degeneration of the Kidneys."

so surely occur at some period during the progress of the case, render it doubly dangerous.

Dr Bright, in 1827, pointed out the connection between dropsy and degeneration of the kidneys. Since then additional information has been added to the subject by more recent investigation, so that, perhaps, there is no other organ in the body whose pathology has been so carefully and successfully studied. Hence we can speak with some confidence of the morbid changes which occur in these organs. Our object, however, is not to enter at length into the pathology of Bright's disease, but merely to take up a few facts which seem to us to throw some light upon the connection between it and disease of the heart.

I. As to the nature of the changes which take place in the kidneys in Bright's disease.

II. Condition of the blood in Bright's disease.

III. Nature of the complications in Bright's disease.

IV. Causes of the complications in Bright's disease.

I. *As to the Nature of the Changes which take place in the Kidneys.*—In Bright's disease the kidneys are found to present various appearances, according either to the stage of the malady, or to the difference in the nature of the morbid process affecting them. This has given rise to a great diversity of opinion among authors on this subject in regard to classification. Dr Bright divided diseases of the kidneys into three forms, Rosenstein into four, Solon into five, Rayer into six, and Rokitansky into eight.

More recently Dr Grainger Stewart* has made the following division, founded on their pathology, which seems to us to present the matter in a clear light.

* Grainger Stewart on Bright's Disease, p. 11.

1. The inflammatory form, of which there are three stages—

a. That of inflammation.

b. That of fatty transformation.

c. That of atrophy.

2. The waxy or amyloid form, of which there are also three stages—

a. That of degeneration of vessels.

b. That of secondary changes in the tubes.

c. That of atrophy.

3. The cirrhotic, contracting, or gouty form.

These forms of kidney disease, although differing in many points, have yet this in common, that they all plainly present evidence of degeneration of one kind or another. The ravages of this morbid process are not found in these cases to be simply confined to the kidneys, but involve other organs and tissues, pointing to the disease as not merely a local one, but depending upon a constitutional cause, on which account it has been called a blood disease. Dr Walshe, in 1849, demonstrated this to be the case. He showed that the lesions which we find in the kidneys are only the local expressions of the constitutional state,* just as tubercle is of tuberculosis; that the blood changes are probably due to a morbid condition of the primary and secondary digestion process; and that Bright's disease is thus to be recognised as one of the typical diathetic or constitutional diseases.

This being the case, we find it occurring at all ages and in both sexes, but more frequently in the male in the proportion of about three to one. The majority of cases are found between the ages of twenty and forty,

* Aitken, Practice of Medicine, vol ii. p. 28.

and the more advanced the disease, and the longer it has affected the patient, the more instances of heart complication do we meet with. Thus, in the inflammatory and waxy forms, it is more frequent in the second stage than in the first, and in the third than in the second. When it does happen in the second stage, the case very often terminates there, the seriousness of the complication hastening the fatal climax of the disease. It also seems to complicate the cirrhotic kidney more frequently than the granular.

In addition to hypertrophy of the heart, other lesions of the circulatory system are far from uncommon, as pericarditis, valvular disease, fatty degeneration of the muscular substance of the heart, atheroma, &c., all consequent upon the kidney lesions; that is to say, all these lesions can be induced by Bright's disease, although, no doubt, in a few instances they may be only casual complications.

II. *The Condition of the Blood in Bright's Disease.*—The density of the serum is lowered, and its solid contents are diminished. This varies in different cases. "It is always, however, considerable, the density, which ranges naturally between 1029 and 1031, being seldom above 1022, often as low as 1020, and occasionally even 1019; and the solid contents being reduced from 100 or 102 in one thousand, to 68, 64, or even 61."* There is also an increase of urea and fibrin. The urea is increased the more the urine is diminished, and the fibrine in proportion to the amount of constitutional disturbance or local inflammation. The albumen and the colouring matter of the blood are diminished, the former most frequently in the earlier

* Christison on "Granular Degeneration," p. 61.

stage of the disease, the latter in its more advanced stages.

III. *As to the Nature of the Complications occurring in Bright's Disease.*—Dr Grainger Stewart gives the following tables showing the percentage of affections accompanying Bright's disease as calculated from "Frerichs":— *

Heart.	Lungs.				Liver.		Spleen.
Hypertrophy without other known cause.	Congestion and Œdema.	Pneumonia.	Emphysema.	Tubercle.	Cirrhosis.	Fatty Degeneration.	Enlargement.
33·75	25·5	9·5	7·5	12·5	8·5	6·5	8·5

Stomach.	Intestines.	Nerve Centres.		Inflammation of Serous Membrane.		
Catarrh.	Catarrh.	Sanguineous Apoplexy.	Serous Effusion.	Pericardium.	Pleura.	Peritoneum.
8·5	11·5	3·5	13·6	4·5	12·5	11·5

"In considering the complications of any particular disease, we should distinguish the following varieties:—

"1*st*, Such as result from the malady—consequent complications.

"2*d*, Such as cause the malady—causal complications.

"3*d*, Such as owe their origin to the same cause as leads to the malady—concomitant complications; and, we might add as a 4*th* class, diseases which accidentally co-exist with the malady—casual complications."†

Of these complications hypertrophy of the heart is directly caused by the renal disorder, and is by far the

* Dr Grainger Stewart on Bright's Disease, p. 311.

† Ibid., p. 90.

most frequent. We also find numerous other lesions of the circulatory system, as fatty degeneration, pericarditis, hydropericardium, atheroma, &c., which are concomitant complications.

These concomitant complications of the circulatory and other organs present for our notice two points in particular. First, that the majority of them are either due to degeneration or inflammation of serous membranes, some of the others being merely premonitory symptoms, as dyspepsia, etc., or casual complications.

The causes of *Bright's disease* are cold, intemperance, syphilis, scarlatina, diphtheria, wasting and exhausting diseases, as prolonged suppuration, caries of bone, tuberculosis, cancer, &c., in fact, all those diseases which lower the vitality of the system and cause a drain upon the blood.

IV. Having noticed these points, let us now see whether or not they throw any light on the relations between Bright's disease and diseases of the circulatory system.

The blood is in an altered condition, on this account, and also in consequence of the obstruction in the kidneys the heart is stimulated to increased exertion, which necessarily entails additional growth of its muscular substance. This change can only advance gradually, which explains the increasing frequency of hypertrophy with the advance of the renal disorder.

There are other causes at work which we think may also have some share in the production of hypertrophy of the heart in these diseases, namely, the presence of anasarca, which, by increasing the difficulty of the circulation either by pressure on the vessels, or by depriving them of a large amount of the fluid part of the blood, leaves it in a condition requiring more power to propel it.

Œdema of the lungs, bronchitis, or effusion into the pleuræ may also assist in developing the lesion. In Bright's disease fatty degeneration of the heart and blood-vessels must be regarded as concomitant complications not consequent like hypertrophy. The other lesions which we have to notice are pericarditis and rheumatism.

In rheumatism, pericarditis is a frequent complication. The blood in rheumatism is in a highly fibrinous condition, and in Bright's disease the fibrin is also increased during the inflammatory period of the disease, at which period the occurrence of pericarditis is most common,—in fact, according to some authors, it is only then that we meet with it. This fibrinous condition of the blood, then, appears to have some connection with inflammation of the pericardium.

Pericarditis is more common in rheumatism than it is in Bright's disease, but this is not to be wondered at, when we remember that the fibrin is augmented in it more than in any other disease, and that the blood remains in this condition all through the course of the malady, and is not, as in Bright's disease, present only in the first stage of the affection. In rheumatism, also, it is when the inflammatory action is highest that pericarditis is most liable to supervene.

In this altered condition of the blood in rheumatism, should we not also expect the heart to be hypertrophied in many cases, as in Bright's disease? Certainly if this condition of the blood continued long enough. In Bright's disease it is only in the most advanced cases that hypertrophy of the heart is met with. But in rheumatism this morbid state of the blood is not permanent. There are often long intervals in which its con-

dition is normal, or nearly so; and it is only when it has degenerated into this unhealthy state, and reached a climax, as manifested by a rheumatic attack, that there is danger to the heart, so that in the healthy interval it is safe from the action of the poisoned blood, and in this manner is preserved from hypertrophy. It is the long continued strain that is more to be feared than a temporary one, even if more severe.

The endocardium—especially those portions entering into the composition of the valves—are frequently affected with inflammatory action in rheumatism, ending in changes which may seriously embarrass the circulation.

In Bright's disease, also, valvular disease is not an unusual complication, and is then, in some instances, probably due to the same cause as the pericarditis, namely, the fibrinous condition of the blood.

Bright's disease is thus a blood disease, due to derangements of the digestive and assimilative powers. The digestive functions are either primarily deranged by the food taken, or secondarily by an influence of the nervous system, by intemperance, by the presence of some poison in the system, as that of syphilis, or by exhausting diseases, which, by lowering the vitality, influence the natural and proper course of digestion, interfere with the elaboration of materials necessary for the healthy support of the body, and induce a depraved condition of the blood, which manifests itself in those morbid changes and degenerations which constitute so large a percentage of the diseases of all the organs of the body.

CHAPTER V.

FUNCTIONAL DISEASES OF THE HEART.

FUNCTIONAL diseases of the heart, in the great majority of instances, occur in the young, seldom after manhood, but in women at a much later period than in men. On this account they can generally be easily diagnosed. If there is no history of rheumatic fever, of hereditary predisposition to it, or of injury, the case may safely be put down as functional. In those more advanced in life we must be more careful, for gradually other causes are liable to come into operation which induce organic disease; and although we may have no symptoms or physical signs of it, we cannot rely upon that as a proof of its absence, as in the earlier stage of some organic heart affections, symptoms are either entirely absent or very obscure, and to get a correct opinion of the case, we must watch it for some time, notice the effect of treatment, and remove any probable exciting cause. Having done this, if we find that it gradually yields to remedies given on the supposition of its functional character, we have good reason to believe that no organic disease exists, and should reassure the patient accordingly, as there is perhaps no other class of affections which have such an influence on the patient's mind as cardiac derangements, and nothing is more essential for their successful treatment than first allaying his

fears, and getting him to take a more hopeful view of his condition.

This accomplished, half the battle is won. And, in order to accomplish it, let your opinion, when given, be given decidedly, for according to the amount of confidence you show will be his faith in your skill, and the benefit he will receive from treatment. It is quite possible in nearly every case to give a favourable prognosis. If you are unable to do so, explain your reason, and in all probability you will lift a load of anxiety from your patient's mind, as the truth is always more easily borne than the pain of suspense.

In young men functional derangements of the heart are most frequent from sixteen to twenty-five, and comparatively rare afterwards. In women they are far from uncommon at a much later period. This is not to be wondered at, as they are more subject to nervous attacks, as hysteria, &c., their nervous system appearing to be more obnoxious to mental and physical impressions than that of the other sex. This is the case more especially during the child-bearing period, only the unmarried suffer in a greater proportion than the married, and among the married those who are barren than those who have children. The former, having less to occupy their time and attention, think more about themselves, and have a tendency to magnify any little ailment, and brood over it. It is also apt to occur on the cessation of the uterine functions. Hence they are more frequent when the nervous system is in a condition prone to receive impressions, or to be disturbed, and when these disturbing agencies are in operation.

Functional diseases of the heart may be divided into two classes:—1*st*, Murmurs due to an altered composi-

tion of the blood. 2*d*, Derangements in its action from enervation, &c.

A functional murmur is one which is caused, not by any disease of the valves, but by a change in the blood. If a fluid is propelled through a tube with sufficient force it produces a bellows-murmur, and a vibration or thrill, which is increased by compressing the tube, because more friction is thereby generated. "The collision of the particles of fluid against the sides of the vessel, and against each other, by producing vibration of a certain rate of rapidity, is the cause of the sound; and these two phenomena, the friction and the murmur, are consequently in the direct ratio of each other. Hence it appears that the murmur is produced in strict conformity with the general axiom, that the particles of all bodies, when thrown into sufficient vibration, generate sound."* It has been frequently proved by experiment, that this murmur and thrill can be produced by bleeding, and that the pulse becomes jerking, although at the same time weaker. The diminution of the quantity of blood leaves less to be propelled, and enables the heart to project it with greater rapidity, and from the increase of friction thereby generated, and the relaxed and unfilled state of the arteries, the vibration is greatly increased, and can be felt.

This condition of the blood can be brought about by many other causes besides hæmorrhage, for although there may be no direct loss of blood, yet, as is the case after hæmorrhage, it may be defibrinated to a serious degree, and left in a thin and watery condition, so that, although the quantity is not greatly diminished, its quality is changed, its weight lessened, and the same

* Hope's Diseases of the Heart, p. 93.

result ensues as if actual hæmorrhage had taken place. In these cases the heart beats abruptly, and more rapidly than is natural, though without any real additional force. This is due to the shock received by the nervous system.

In this state of the blood the murmur may continue until the blood has returned to its normal composition, or it is only when a sudden stimulus is given to the heart by the nervous system that a murmur is produced, and which lasts, according to the strength of the exciting cause, from a few seconds upwards.

The venous murmur is also due to anæmia. Bouillaud notices this, and says,—"All the patients in whom I have hitherto met with it had a peculiar constitutional condition, if not a real state of anæmia, at least a state of the blood in which the serous portion predominates over the red particles and fibrine."

Now, what are the conditions under which this abnormal state of the circulating fluid is developed? First, of course, comes hæmorrhage, especially when it is sudden and copious; then, when it is smaller in quantity, but frequently repeated, as in menorrhagia, piles, epistaxis, &c. These cause anæmia in the literal sense of that term; though we have said that it is also now accepted to embrace an altered condition of the blood, in which the fibrin and real corpuscles are diminished. To induce anæmia of this kind very many causes are at work. First, there are derangements of the stomach, preventing the blood from receiving a proper supply of nourishment to repair and keep it up to its standard; diseases of the digestive system, interfering with the elaboration of the food; or disease of the spleen, as in leucocythæmia, destroying the manufactory of the blood corpuscles. Second, are the causes which make too

great a demand upon the circulating fluid, requiring more from it than in the normal state it can supply, or under the usual routine can be replaced. Hence it is gradually impoverished, as by carcinoma, tubercular affections, Bright's disease, diabetes, chronic suppurations or discharges, as protracted nursing, leucorrhœa, diarrhœa, &c. In many different cases of these affections the blood has been examined, and in them all it presented the characteristics of anæmic blood. "It is very important, in a practical point of view, to remember that every acute disease which occurs in an anæmic individual assumes a peculiar character—a very high degree of debility ensues, convalescence is protracted, and all severe intercurrent diseases acquire a lingering course."*

All the symptoms of this disease show this condition of the blood to be real. The face is pale—sometimes, even, it has a yellowish or leaden tinge; the mucous membrane of the mouth and lips is pale also, proving the scarcity of the red globules. The tendency to dropsy shows that the blood has lost in density, and the general symptoms of prostration and languor point to it as being insufficiently rich in nourishing constituents. Further corroboration of the correctness of this theory lies in the fact, that treatment employed with the view of stopping these discharges, as the administration of tonics, in the form of iron, bitters, &c., with good food and change of air, is very successful in their removal.

Besides the causes of anæmia we have already referred to, there are others which we can only name—as imperfect oxygenation of the blood from defective ventilation, excessive mental labour, pain, grief, care, &c. We have thus seen what the condition of the blood in

* Aitken's Practice of Medicine.

anæmia is which induces these functional murmurs of the heart, and the agencies which tend to bring about that altered condition. The knowledge of these things should avail us much in their prevention, the rules for which may very briefly be summed up, and cannot be too forcibly impressed upon our attention. They are good but simple food, exercise and fresh air, and the avoidance of any indulgence that can impair either the physical or mental powers, as different causes bring about the same result; so that although we may be very careful on one point, if improvident in another, the good is more than counterbalanced ultimately, as nature does not allow of any such compromise.

We now come to the second class of functional diseases of the heart—derangements in its action from enervation. Under this head comes palpitation in all its degrees,—palpitation with occasional irregular action of the heart, with feelings of faintness or actual syncope, &c. We very often find it accompanying anæmia,—sometimes it is its most prominent symptom. Murmurs and vibrations of the venous system are due to a mechanical cause. In the class of affections we have now to deal with it is far otherwise. They are occasioned by the altered condition of the nervous supply of the heart, induced by the poverty of the blood in anæmia, which renders it more easily affected, the nerves being unable to resist influences which in health would not produce any disturbance.

Many different kinds of palpitation have been described, but the only title they have to distinction is in their being attributed to different lesions, leaving us to imagine that it is merely a symptom of several diseases, without any special pathology of its own. But if we examine these various so-called causes, we find that they

induce one result in common, viz., enervation; then, and then only do we have palpitation.

This is then the direct cause, the others being only predisposing ones, on account of their invariable tendency to terminate in the condition of enervation. In those persons suffering from diseases which are exciting causes of palpitation, there is one train of symptoms always very obvious both to themselves and friends,—nervousness. It is their constant companion, and manifests itself in their manner, often to a painful degree. In such individuals the muscular action is frequently irregular, as evinced in the occasional tremors of the muscles, increased on the slightest mental excitement. But the heart, from the fact of its being an involuntary muscular organ, is fortunately not disturbed so easily, and only manifests its sympathy in the first instance by quickening its normal contractions, whereas the voluntary muscles contract involuntarily, the nervous current being weakened and slightly interrupted.

The next point to determine is, what is the nature of the lesion. We have seen that it is evidently one of the nervous system, so, it may either be due to some morbid condition of the nerve centres, or their conducting media, or to a deficiency of nervous force, without of necessity there being an alteration of structure of the mechanism where it is generated.

Chemistry and the microscope have of late years thrown light upon many obscure pathological changes, which formerly in our ignorance we were unable to detect, so that many diseases, at one time termed functional, we now know to depend upon structural lesions. This advance of medical science makes us hesitate, then, to attribute these derangements of the heart to merely

functional causes. But while our being unable to detect any lesion may not be proof positive that such does not exist, it must be remembered there is nothing to show that it does exist. Therefore we must be content to accept for evidence what we are enabled to produce with the means at our disposal, and which, no better being forthcoming, must be held valid.

In many cases we can detect no structural changes, either in the nerve centres or their conductors, and all the symptoms contra-indicate the probability of our being able to do so. Besides, if we can account for them on other grounds, that is a sufficient reason for excluding structural changes, at the same time we admit that such would induce the same result. The history of the cases, their amenability to treatment, all tend to confirm us in this opinion.

The nerve centres are like the cells of a galvanic battery, in them the force is generated and conserved for emergencies. A diminution of the current is not in the least incompatible with soundness of the conducting material, or with the absence of structural change in the cells. An engine works more slowly at one time than at another, yet its machinery may be perfect. So it is, we believe, in the case before us. The amount of force kept in store is diminished, or its generation is not so actively carried on as in health. But there is a peculiarity about this nervous force. It can, undoubtedly, be repaired, but only to a certain extent, slowly and far more slowly than the tissues. In convalescence from fevers, how rapidly are muscle and fat regained, but how comparatively slowly do the nervous symptoms disappear, remaining long after all the other symptoms have vanished. Hence, we believe, that there is an amount of

inherent nervous force given to each individual, capable of being repaired only to a certain degree, and intended to last the economy through life. For in how many do we see the loss to be almost irreparable, who have wasted it heedlessly, either mentally or physically, rendering nervous diseases, when due to this cause, so prolonged and intractable to treatment.

The most common form of functional derangement of the heart is palpitation, or increase in the force of the heart's contraction, without necessarily increased frequency of beat. In severe cases the rhythm becomes disturbed, the heart acts irregularly or intermits, and its action may be much quickened, or *vice versa.* This may continue for almost any length of time, from an occasional attack after some indiscretion at table, or after violent exercise, or it may be almost a constant companion. The heart and valves remain unchanged and entire in their structure, yet, from the amount of suffering it causes, mentally and bodily, we are more frequently called upon to prescribe for its symptoms, than in many a case of serious organic disease.

Dr Walshe describes the symptoms of this affection so well, that we cannot do better than give them in his own words. "Consciousness on the part of the patient of the heart's action, seems, at the least, an almost invariable attendant on palpitation. A variety of subjective sensations may be enumerated, occurring singly, in groups, or all of them combined. Such are choking sensations, a form of globus, or feel as if the heart were jumping into the throat, and the eyes bursting from the sockets, præcordial anxiety, faintness, actual syncope, or partial unconsciousness. If præcordial pain exists, it commonly amounts to little more than a sense of dull, aching sore-

ness. But I have, in a very few cases, known very severe pangs, similar to those of angina pectoris, attend the paroxysm. Such pains are sometimes relievable by pressure of the hand, even when the patient cannot endure the recumbent posture on the left side. Hurry of respiration to any very notable amount is of rare occurrence; it does sometimes, however, reach a degree out of proportion with the pulse, giving the patient the appearance of a person out of breath with running. Tinnitus aurium, vertigo, and confused vision, cephalalgia, heat of the head and flushed face, and clammy coldness of the extremities, add themselves to the list of disturbances. Although this be more common when rhythm is perverted, yet, even in attacks of simple palpitation, there may be extreme general distress and fear of death,—singularly enough, more of this often than in cases of palpitation of organic origin! The consciousness of local suffering is rather in the ratio of the general and local sensibility, than of actual palpitation."*

From this account we see how many and distressing are the symptoms which palpitation induces, and both from these and its frequent occurrence, it demands our first attention. Increase of the force of the heart's contraction may be due to several causes,—to increase of its muscular power, or hypertrophy, which has taken place in consequence of some obstacle to the circulation. But in cases of this description, from the increase of force taking place so very gradually, and from the necessity there is for its presence it causes very little inconvenience, sometimes even may not be perceived by the patient. This, however, is not true palpitation, as it may even supervene in these cases. It may also be due

* Walshe's Diseases of the Heart, p. 170.

to the rapidity of the circulation being increased by healthy exercise. In these cases the increase of the force of the heart's contraction is normal, and a safeguard which prevents congestion of other organs. The exciting causes of palpitation do not affect those who are healthy, so that unless the heart is enervated, they are powerless to disturb its action. Hence palpitation may be defined as a sudden increase of the power of the heart's contraction in an enervated heart. It is only in a heart so weakened that it could take place to an extent deserving the name; as its inherent vigour would otherwise prevent it being so excited, and enable it to withstand the stimulus. The palpitation continues in ratio of the power of the exciting cause and the degree of the heart's weakness.

Such being the condition of the heart, the knowledge of it will enable us the more readily to detect its causes. We shall now examine the agencies which are at work in enfeebling the heart, these being the direct causes of palpitation.

Dyspepsia and palpitation are so often combined as to have become considered as cause and effect. Now, this is true to a certain extent. Palpitation is frequently an ulterior consequence of dyspepsia, but it is not an immediate one, for we find that if there is no other cause in operation, the dyspeptic symptoms may continue for some time, and that it is not until the disease has advanced so far as to interfere with the healthy nutrition of the body palpitation begins to manifest itself,—not until, from imperfect digestion, the blood is impoverished, the patient becomes anæmic, and the nervous system involved, then palpitation begins to shew itself, but not till then, and of this we have sufficient proof.

Let us take tea, coffee, and tobacco, all of which are

well recognised as causes of palpitation, and see how they act. In strong doses they directly affect the nervous system, first exciting it and keeping it in a high degree of tension, but when the stimulant's effect passes off leaving it weak and depressed. Then palpitation may ensue without there being dyspepsia. Dr Stokes relates the case of a gentleman who was seized with so severe an attack that he thought it would prove fatal, and the cause of it was his having drunk too much strong tea on the previous evening while sitting up with his uncle, who was leaving by an early coach next morning. In this instance it was the direct influence of the tea on the nervous system, leaving it exhausted after the stimulant effect had passed off. We have also seen cases in which tobacco was the cause, in which there was not one dyspeptic symptom present. The nervous system being primarily and solely affected in these cases, the success of treatment by stimulants and opium confirm this fact. Over study and mental work induce the same result by the constant demand they make upon the nervous system, exhausting it, and leaving it unable to resist injurious influences, and that this deprivation must readily affect an organ like the heart can be easily conceived, which, compared to the other organs of the body, gets no rest except in a slight diminution of its action during sleep. Accordingly, in all these cases, the nervous system is at fault, and anything affecting it so as to impair its power must be looked upon as a possible cause of palpitation. There is another functional disease of the heart which we will only mention here, as we discuss it at more length in another chapter, viz., functional angina pectoris. It is also due to enervation, derangements from which cause may be thus arranged according to their severity :—

1*st*, Palpitation, simple.
2*d*, Palpitation, with irregular action.
3*d*, Functional angina pectoris.
4*th*, Syncope.

We must not omit here a functional complaint, not of the heart, but of the aorta, especially of the abdominal portion, namely, abnormal pulsation. It is frequently a source of great annoyance and fear to the patient, and is sometimes mistaken by the practitioner for aneurism. It is due to the same cause as functional murmurs, either to a diminution in the quantity of the circulating fluid, or to an altered state of its composition, allowing the heart to propel it more easily, giving it a jerking action, and making pulsation to be felt where it otherwise ought not to be. This is usually noticed in thin and emaciated people in the epigastrium, or, if the arch of the vessel is unusually high, in the supra sternal notch.

"The nerves of the heart may be affected in two ways. They may labour under over excitement, dependent either on increased irritability, or on inadequate stimulation. These states when existing in a moderate degree cannot strictly be considered morbid. Thus, palpitation from exercise or from exhilarating mental emotions, and languor of the heart's action from a depressing passion, do not rank as diseases. But when the states in question exist in excess, and when they result, less from remote sympathies than from a primitive affection of the nerves of the heart itself, they constitute diseases. Of these the state of over excitement comprises neuralgia of the heart or angina pectoris and palpitation, while the state of deficient excitement presents syncope."* But from what we have said of the manifestations of diminished nerve

* Hope's Diseases of the Heart, p. 468.

force as manifested in muscular fibres, we know that what Hope describes as increased irritability and diminished irritability are only degrees of the same condition, the former being the earliest symptom of weakened nerve power, and gradually merging into the latter as the weakness increases. There are other derangements of the heart which, although they do not come under the ones we have mentioned, are not the less worthy of notice. In functional murmurs the blood in the heart is diminished in quantity and density. Now, in the opposite condition, when the heart is overloaded, its function is also interfered with, as when, from over-exertion, congestion of the lungs and rigid heart takes place, occasionally terminating fatally, but when less severe causing a feeling of suffocation and præcordial tightness and pain, the heart acting more forcibly, but to less purpose, as is shown by the pulse being weaker than natural.

The state of the atmosphere and temperature cause disturbances of the functions of the heart which, although at first simply functional, may terminate in structural change of that organ. In deep mines, where the atmospheric pressure is greatly increased, the functions of the skin and lungs are impeded, producing congestion of the circulatory and respiratory organs. In a warm temperature the heart's action is excited, the nervous system is relaxed, the arterial walls expand, and the rapidity of the circulation is increased. Extreme cold induces the opposite result, and causes congestion of the heart. Reflex irritation also produces temporary derangement of the heart, as from the presence of undigested substances in the stomach, worms or excrementitious matter in the intestines, &c.

From the mode of action of the causes of these

functional complaints, we find that when they act directly the derangement is generally very temporary,—although, in some cases, it may be very serious, even terminating fatally; while, when they act indirectly, the result is not so speedy, but is more troublesome from its persistence, and the difficulty there is of restoring the disordered functions to health. Examples of the latter are the most frequent.

The function of the heart, then, can be deranged either through the blood or the nervous system. Through the blood, by its being altered in quality or quantity, as in anæmic murmurs. By the nervous system, from reflex irritation, or from diminution of nervous force. Of these as a rule, examples of the latter kind are the most serious, because they are the most difficult to repair, the effects being liable to remain long after the operation of their cause has ceased.

In palpitation the stimulus may be either conveyed directly or indirectly: in the former case by the blood; in the latter by the nervous system.

When we consider the delicacy of the organ of circulation, its sensitiveness to impressions, and how easily its function is disturbed by internal and external agencies, instead of wondering how common heart disease is, we ought rather to be surprised that it is not of more frequent occurrence, when we see how little precaution is taken to preserve it from injurious influences. Now indeed we hear more of heart disease than formerly. But is it because it is on the increase, or is it because we now understand its symptoms better, and can diagnose it with more certainty? We believe it is for both reasons. We can now detect it, when formerly it would almost have

been an impossibility, or, at the best, a matter of the faintest surmise. But at the present age diseases of the nervous system are undoubtedly on the increase, and this may account for the fact that the most numerous and important class of functional derangements of the heart depend upon enervation.

CHAPTER VI.

A CAUSE OF HEART DISEASE IN THE ARMY.

In studying cases of heart disease, we frequently meet with some in which the lesions are so serious as to indicate themselves by symptoms which the merest tyro in diagnosis could hardly fail to appreciate, but which puzzle us on account of our inability to trace them to their original cause. For instance, in many cases of hypertrophy of the heart, dilatation and aneurism of the aorta, we console ourselves by attributing them to disease of the arterial coats, Bright's disease, &c.; and although not for a moment do we lightly consider the grave effects which may result on the organs of circulation from these causes, we feel that they do not in a conclusive manner prove themselves to be the first causes in all cases, in some perhaps not showing the faintest connection between cause and effect, although no doubt they may aggravate or accelerate these pathological conditions.

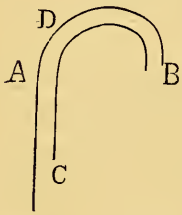
It was this feeling which, after the perusal of Mr Myers' essay "On Diseases of the Heart among Soldiers," led us to examine somewhat minutely the anatomy of the organs of circulation, in the hope of thereby satisfying ourselves as to the correctness of a theory which seemed to us to offer a more reasonable explanation of these cases than any we are acquainted with.

In works on anatomy the heart is described as being

contained in a bag called the pericardium. Now, if we examine its connections with this bag, we find that it is only attached and held in position at its upper extremity by the large blood-vessels and the reflexion of the pericardium, so that it is always more or less suspended by these attachments in the pericardium when the body is in any position but the recumbent.

From this we see that the aorta has attached to it at the commencement of its ascending portion a weight, which, according to Reid's investigations, varies from about 8 to 10 ounces in the female, and from 10 to 12 in the male. This weight will naturally be increased to some extent by the amount of blood contained in the organ when it is in action, and by the recoil after each contraction of the ventricles.

If we look at the aorta, which takes the form of an arch, with this weight attached to one extremity, we will see that this mechanical arrangement places it under certain disadvantages in peculiar circumstances; for although, by nature's wise provision, any slight change which might result in the curve of the aorta by its being drawn down by the weight of the heart is probably compensated for by the time we require for sleep allowing the vessel to regain its elasticity, still we must perceive that any circumstance acting so as to increase this weight must necessarily entail very serious consequences on the arch of the aorta.



For instance, take AB as the arch of the aorta, and *c* the weight or heart attached, we find that the weight *c* will tend to diminish the radius of the arch, and render the angle of the curves more acute,

thus increasing the opposition to the current of the blood, especially at the point D. What will happen then? Hypertrophy of left ventricle, dilatation of the aorta behind the point of obstruction D, and affections of the aortic valves. The risk of aneurism of the aorta at the commencement of the arch will also be increased, thus entailing a series of very grave results.

First, as to the position of the heart; it hangs obliquely, simply due to its point of attachment, and not because of receiving support at any other point in addition.

Does the diaphragm assist in its support? Very little, if any, because in every inspiration it descends, while the heart is raised, so that during inspiration, at least, it has no part in its support, and little, if any, during expiration, because it is the side of the ventricle which comes in contact with the diaphragm, which being lax, will yield before the heart's weight, thus affording it only a nominal support, for, except in the case of children, the diaphragm is more a muscle of inspiration than of expiration. Again, the greatest amount of exertion is always made during inspiration, so that the heart is more freely suspended then than at any other time. If we now examine the pulse, we shall obtain from it proofs that in certain positions of the body the heart has less support than in others. Graves, I think, was the first to point out the difference in the pulse in the erect, semi-erect, and recumbent position. It is most frequent in the erect position, the difference being from six to fifteen beats in the minute, from which he deduced the conclusion, that the maximum of strength and the minimum of frequency are attained together, and he applies this fact to the explanation of the relief

produced by the horizontal position in syncope. To account for this the heart is either placed in a more favourable position for carrying on its work, or the demand for its work is diminished, or, what is still more probable, there is a combination of both these conditions, which renders the strength of the pulse greater, and its rapidity less, in the horizontal position than in the erect. First, Let us consider how the position of the heart has anything to do with this fact. In the erect position it is, as we have already said, suspended, receiving only protection and facility of movement from the pericardium, but no persistent support at any part, while in the horizontal position the heart lies on the pericardium and lung, which give it a *point d'appui* for its action, and enable it to act with greater force. This partial support is the only one useful and free from danger, because if it exceeded this the action of the heart would be interfered with ; but in this case, the small amount of interference with its action is more than compensated for by the purchase it gets during each contraction from this point of resistance. Second, The other cause at work is, that the waste of tissues is less in the recumbent position, the whole muscular system being in as complete a state of rest as is possible ; hence the work of repair does not require to be so much hurried. Third, The heart is also relieved in the horizontal position, from the fact that the mere weight of the column of blood in the ascending aorta and vessels of the head and neck has not to be overcome, the force required to drive the blood perpendicularly upwards being necessarily greater than that required to propel it on a level. This also relieves its work.

Thus we see that in the erect position the heart and aorta are placed under certain disadvantageous circum-

stances. The heart has to overcome during each contraction the weight of the column of blood in the ascending aorta, and so requires to act with more strength. Still more so if exercise is taken in that position, especially exercise of the upper extremities. At the same time, the arch of the aorta is exposed to the risk of having its curves made more acute by the weight of the suspended heart, and the force of the current of blood being increased, acts all the more speedily at the point of obstruction, namely, the angle D, so that certain external circumstances, taken in conjunction with this mechanical arrangement of the heart and aorta, come to be considered as important causes of disease of the organs of circulation. Starting from this point, that the erect position places the heart and aorta in circumstances favourable for the development of certain serious lesions, we shall examine and see under what conditions the risk of the formation of these lesions is increased.

First, of a certainty, comes long continued maintenance in that position, especially if constrained by rule or dress. Secondly, exercise of the upper extremities while in that position; and it is because these two unfavourable conditions are so prominently met with in our foot regiments, that we have headed this chapter a cause of heart disease in the army.

All physical exercise increases the rapidity of the circulation, and the part exercised, or in which the greatest waste of tissues is taking place of necessity requires an increased supply of blood to repair that waste. Hence, if using the arms in the erect position, be indulged in to too great an extent, the heart is stimulated to increased work under adverse circumstances. The curve of the aorta being rendered more acute by the

heart's weight, offers increased resistance at the point D; and the heart acting with greater rapidity, keeps up the strain at that point more continuously, so that it tends gradually, but surely, to weaken the elasticity of the middle coat, and render the angle at D more acute, which, when it happens, causes dilatation behind that point, &c. So much the more surely and speedily does this train of evils follow, if the aorta is in the least degree affected with atheroma, a condition which not only hastens these evils, but, as may easily be conceived, may add aneurism besides. This will be apt to occur at the point D, where the force of the blood is most directly received, so that not only is the strain on the heart increased by the necessity for more work, but, at the same time, a mechanical obstruction to the flow of blood is caused by this arrangement of the parts. This danger is augmented, we believe, by the constriction caused by the soldier's accoutrements, as Mr Myers has shown in his essay; but that this constriction, due to the uniform, should be the sole cause of the prevalence of heart disease in the army, cannot be admitted.

Mr Myers has shown, from his careful examination of cases of incipient heart disease in the army, that the first lesion distinguishable is hypertrophy, which is just what we would expect from our theory of its cause, dilatation of the aorta probably occurring at a later date, at least not being so easily diagnosed in its earliest stage as hypertrophy. This cause of heart disease is, of course, at work in others besides in soldiers,—as in our labouring population, &c.,—only we have not in them the same opportunities of watching the gradual occurrence of the symptoms of these affections in their earlier stages, many not seeking relief until almost *in extremis*, and then we

have to content ourselves with noticing the existing changes, as we can gain little reliable information as to the origin of their maladies. But from the fact that in the army, these changes have been carefully watched and studied from the very beginning, we have more confidence in speaking of them; so that Mr Myers's careful observations have the more weight, as they directly bear on the point in question, and as he made them in support of his theory, cannot, when applied to ours, be accused of any partiality.

If our theory is correct, we should expect to find that the cardiac lesions most frequently met with among soldiers are diseases of the aortic valve, aneurism especially of the ascending aorta and arch, and also we should expect these lesions to occur more frequently in the army than in the civil population, in proportion to the number of cases of heart disease. The diseases of the heart most common in the army, according to Mr Myers, are hypertrophy, aneurism, and disease of the aortic valves, for from post-mortem records which he made at Netley, he found that in 97 cases valvular lesions occurred as follows:—Of aortic v. disease, 50; mitral, 25; mitral and aortic, 22. He then quotes the "British and Foreign Medico-Chirurgical Review," vol. xiv., as showing the comparative frequency of these valvular lesions in military practice. Total number of cases, 673.

Aortic V. Disease.	Mitral V. Disease.	Aortic and Mitral V. Disease.
192	205	259

From this we see that in the cases taken from civil practice the majority have both sets of valves affected, and that the mitral alone are more frequently attacked than the aortic, showing that aortic valvular disease is,

at least, more common in the army than in the civil population. This is explained by the strain upon the left ventricle, from the long continued and frequently repeated exercise with the rifle, which renders the aortic valves more liable to be affected, and by dilating the aorta behind the joint of obstruction at the angle D tends to make them incompetent. Next in order, we should expect that aneurism of the aorta would have a prominent position as one of the diseases of the circulatory systems among soldiers, and so we find it has. And from what we have said of the mechanical arrangement of the parts, we would naturally expect to find the arch the part most subject to aneurism, and next in point of frequency the ascending portion of the aorta.

"Dr Sibson in his 'Medical Anatomy,' records 703 cases of aorta aneurism, of which 420 involved some portions of the ascending aorta; and he concludes that these tumours most frequently arise from the part of the vessel against which the greater force of the blood is directed."* Now, if this view be correct, and if it is true that the circulation of the soldier is more subject to mechanical obstruction than that of the civilian, then the site of the disease in the soldier should especially corroborate the result of Dr Sibson's investigations; and that it does so the following statistics prove. Of 109 cases of aneurism of the aorta, there were of the

Ascending Aorta.	Arch.	Descending Aorta.	Thoracic Aorta.	Abdominal Aorta.
37	38	12	7	15

"These cases have been abstracted from the post-mortem and museum records of Netley Hospital, care having been taken to exclude some which were not of soldiers,

* Mr Myers on Heart Disease in the Army.

and from the post-mortem records of my own regiment since 1861."* From these cases we see that our inference was correct, and that a large majority of them were due to lesions of the first two portions of the aorta. This special prevalence of aneurism in these two portions of the aorta had been noticed more than once, as Mr Myers states, first, by Drs Hunter and Queen, on the cause of heart and aortic disease in the army, which they published in 1836, in the first volume of the "Transactions of the Medical and Physical Society," Bombay. Then again in 1867, Staff-Surgeon Hyde published the report of a case of aortic aneurism, *vide* "Army Medical Report," 1867, to which he appended the following remarks:—"The absence of atheroma in the coats deserve notice; it will probably be evolved as these cases are more observed that numerous instances of aortic aneurism in the army are unconnected with any special pre-existing structural degeneration of the arterial system; that they frequently commence under strain as sacculated projecting pouches of the entire vascular coating." This case is of great importance, because it is held at the present day by many pathologists that there is no case of aneurism of the aorta without disease of the arterial coats in the first instance, *i.e.*, excepting a dissecting aneurism, and perhaps this opinion might hold good were the arch under all circumstances to retain its original curve. But when, as we have shown, it is frequently exposed, especially in the army, to influences which tend gradually to render the angle of the curve more acute, we are not so surprised at the absence of atheroma, as we have sufficient to account for the formation of aneurism without falling back upon it. Hence placing atheroma and hypertrophy out of the ques-

* Mr Myers on Heart Disease in the Army.

tion, as not being of themselves sufficient to account for the production of the lesion, the only other possible agent in its formation is some obstruction to the flow of blood at that point of the aorta,—an obstruction, the nature of which we have already described. Another fact which throws some doubt upon the idea that atheroma is almost the sole cause of aneurism of the aorta, is that, in the army, cases of aneurism are met with at a much earlier age than in the civil population, and in some at an age when atheroma is very rarely found, and certainly there is no reason why atheroma should occur at an earlier period in the soldier than in the civilian. Hence, all the results of Mr Myers' investigations tend to confirm the soundness of our theory, first, as regards the nature of the lesions which it entails; and secondly, as regards their comparative frequency.

We have already stated that these serious lesions are induced by the long continued exertion made during drill by carrying the rifle, and going through the musketry exercise, the body being for the most part of the time in the erect position.

How do we propose to remedy this? It is very simply done, by diminishing the amount of rifle exercise, and this could easily be managed without interfering with the efficiency and regularity of the movements which are the pride of the drill-sergeants and officers. The rifle drill *per se* is not difficult to master, and when once thoroughly mastered is not easily forgotten. We should propose that company and battalion drills should be done for the most part without the rifle, and although it might not look so military or imposing, yet when we put on the one side appearances, and on the other the danger of heart disease, no one, I hope, will fail to see the necessity of

yielding to the latter. All these drills could be done in this way with an occasional exception, as that of an inspection or field day. And we would venture to say that on these days of extra exertion the men would go through them better, and with less fatigue or risk of after injury to their circulating organs than according to the present system. When we consider how small our army is compared with those of other countries, we have the more reason to keep the men in as sound and active a condition as possible. It would also prevent a great loss of men from invaliding, and thus would be more economical both of men and money.

Considering the many advantages that would be gained by adopting this method, we think it is an innovation which would more than amply repay its introduction, by rendering the men stronger, and more able to undergo any prolonged exertion, and by giving to the officers a better body of troops to command.

CHAPTER VII.

ANGINA PECTORIS.

ANGINA pectoris is a subject on which a great deal has been written both by British and foreign authors; still, there are as many conflicting theories and opinions as to its nature now, as there were when it was first brought under the notice of medical men by Heberden.

This seems rather surprising, when we consider how great an advance the science of medicine has made since then, especially by detecting changes of structure, undiscoverable to the naked eye, by means of the microscope. Certainly we now know the morbid appearance of the heart and large blood-vessels found on dissection in cases of angina, and we are also less liable to make errors in diagnosis. Still, there has not been so much more light thrown on the subject as we should naturally have expected.

Having carefully examined the different accounts of this disease, and reports of cases, there are some points which, to our mind, offer a solution of the difficulty, and which help to clear the way to an understanding of the pathology of angina pectoris. Although many differ so widely as to the cause of angina, we find them agreeing on this point, that, in the majority of cases, it is a disease of advanced age, the cases occurring in the young being few and exceptional, and having, perhaps, on this account not received the attention they deserve in the

discussion of this question. What is more especially to be noticed in these cases is that it is never fatal, while in the old it invariably is. Nearly all the writers have failed to see, or, at least, to appreciate this distinction, and to separate these two sets of cases. The former we should call functional, the latter organic angina pectoris.

We shall now proceed to give our reasons for believing this distinction to be justifiable.

When it occurs in the young it is always curable, and no organic disease of the heart or blood-vessels can be detected by the most careful examination. In the other class we can nearly always find signs of organic disease during life; if not, we are sure of finding them after death. The cases of functional angina, compared to the number occurring in the old—or organic angina—are very few, as the following table of Lartigne will show :—

	à 17 ans . . .	1 (Macbride.)
	à 21 ans . . .	1 (Van Brander.)
	à 21 ans . . .	1 (Despartes.)
	à 29 ans . . .	1 (Gintrac.)
de 30 . .	à 35 ans . . .	6
	à 40 ans . . .	2
de 42 . .	à 50 ans . . .	11
de 51 . .	à 60 ans . . .	25
de 61 . .	à 70 ans . . .	15
de 71 . .	à 77 ans . . .	4

Still they are more important as regards diagnosis and treatment; for, in the young, and in those in whom it is simply functional, that is, not due to any appreciable organic change, we find it rapidly amenable to treatment and curable. Hence, the importance of distinguishing it from a disease so formidable and invariably fatal as organic angina, in which treatment can only be palliative. An-

other reason why we consider these cases functional, is because they occur at an age when degeneration of the heart's muscular substance and calcareous disease of the coronary arteries are never found. We can discover no symptoms of organic disease, and, as we have mentioned above, they can be cured; while we know that angina pectoris depending on organic disease is incurable, and from its nature must be so. Another reason is, that it occurs in the young at an age when functional derangements of the heart are far from uncommon, and degeneration impossible. We find it also chiefly in the nervous and hysterical, or in those suffering from weakness, from whatever cause, as over-smoking, or over-studying in young men, accompanied generally by dyspeptic symptoms, the angina being due to a heart weakened, or sympathetic with irritation in other organs, and speedily giving way to treatment directed on that supposition.

Then, if we look at the morbid changes which we find on dissection in cases of organic angina,—for we happily never have an opportunity of doing so in the functional cases,—what are they? Principally degenerations of structure, as fatty heart, calcareous disease of the coronary arteries, accumulation of fat on, or in the muscular substance of the heart, &c., all of which interfere with its proper supply of nourishment, and gradually paralyse its action. These are changes which all show the presence of depraved vitality, due either to the decay of nature, or brought on by intemperance and high living, deranging and modifying healthy nutrition. In the young we can have neither of these conditions. The age excludes the possibility of structural changes from degeneration, and intemperate habits could not have lasted so long as to induce them. Then, again, in the organic cases, the

course of the disease, whether long or short, always terminates fatally, as a rule, the attacks increasing in severity and duration with the advance of the disease, remedies having no power to prevent the result; while in the functional, the course of the disease is never long and never ends fatally. All these we think are indisputable reasons for the separation we have made of angina, into functional and organic.

The most puzzling cases, however, are those in patients who are in or near the prime of life, in whom we can detect no organic disease of the heart or circulatory system, but still who are of an age not incompatible with degeneration of the heart's substance. In these, we must confess, very difficult cases, if we find that during a paroxysm the pulse is regular and of fair strength, although, perhaps, a little weak, and that after treatment, directed to the nervous system or stomach, the attacks diminish in frequency and ultimately cease, we may diagnose a case of functional angina.

The most important point to be attended to is the character of the pulse during the paroxysm. If it is very feeble, irregular, intermittent, or unusually slow, prognosis ought to be unfavourable, and organic disease suspected; but if we should find none of these indications present, we may give the patient the benefit of the doubt, and treat accordingly.

Without this separation, we can see how cases so very dissimilar could only be explained by many and various theories, and how utterly impossible it would be to reconcile them. Many of the old authors attributed angina pectoris to nearly every lesion found in the heart and large blood-vessels, as calcareous degeneration, or inflammation of the aorta; some even went so far as to

believe it connected with cancer of the uterus, or adhesions of the pleuræ. Then, again, by some it was called a neurosis, by others a gouty inflammation, nearly every medical man having an opinion of his own, distinct from his neighbour's. Now, with the advance of pathology we can, so to speak, circumscribe these lesions; and, looking carefully at their history and progress, we find the only connection they have in producing angina is, by their all tending directly or indirectly to interfere with the nutrition of the heart, and so weaken its action; a weakened heart being the only lesion never absent in cases of angina, and, what is more conclusive, often the only lesion present, many of the other lesions found in these cases being mere accidental complications.

The following is a case in point:—A. W., aged fifty-one, admitted into the Royal Infirmary in 1865, and said to be suffering from an aneurism. His complaint commenced three years before admission. He complained of angina pectoris, cough, and spit which contained traces of blood. On examination, face and neck were found swollen, cheeks had a congested venous hue. There was a tumour, pulsation very obscure to right of sternum and about its middle, size of a large egg, and hard to the touch. The cartilages of ribs and sternum were pushed out and involved in the tumour, but not altogether absorbed. Tumour dull on percussion; dulness extended across to left nipple, and from the top of the sternum to between the fifth and sixth ribs, systolic murmur at base not heard in the tumour. Patient died seventeen days after admission.

Post-Mortem.—The prominent thoracic tumour was cancerous. It affected the sternum and part of the pectoral muscle, ribs, and subcutaneous tissues covering

these parts. The anterior mediastinum was occupied by numerous hard white masses of cancer. These masses connected together the bone, pericardium, part of the anterior margin of the lung, and part of the diaphragm, so as to make those parts an almost inseparable mass. The visceral and parietal layers of the pericardium were covered with masses of cancer. The disease also involved the substance of the heart. The aorta was pervious, and the right innominate vein was occluded and cancerous. From this dissection, we see that the heart's action must have been seriously interfered with, by the extensive adhesions and deposits, and that the muscular substance of the heart being encroached upon, tended, if not to degeneration, at least to atrophy, and so produced a weakened heart, as readily as fatty accumulation or degeneration could have done. In the same manner we can understand how aneurismal or other tumours, involving or causing pressure on the heart, might also produce, in like manner, angina pectoris.

Having thus separated the functional from the organic, and briefly mentioned the lesions found in the organic cases, we shall now consider how we should name it. To apply the term neurosis to all these cases indiscriminately would be absurd; still we think we may call functional angina a neurosis, by which we mean that its symptoms are all due simply to a derangement of its nervous supply, all our pathological skill being unable to detect any lesion.

These symptoms point, we believe, to the paroxysm as a slight paralysis due to enervation, and generally excited by some sudden exertion, bodily or mental. The heart's substance being otherwise healthy, and having undergone no degeneration of structure, rapidly recovers its irrita-

bility. How different is a case of organic angina! The symptoms are also due to a paralysis; but here the lesion is a serious change in the muscular substance of the heart brought on by different causes. Hence the difference in the history and progress of the case. The paralysis occurs in the one, in a comparatively healthy heart, while in the other, it is weakened by the inroads of disease. Thus, although the heart recovers itself at first in organic angina, it is due to the fact, that in the commencement of the disease the attacks are slight, but as it advances, they become more frequent and severe, the heart is gradually worn out and fails to recover itself, and the result is fatal. So, while we have reason to call the functional attacks a neurosis, we have none to call the organic so. A careful examination of the dissections points to a weakened heart, as the immediate cause of the paroxysm in both; in the functional, the heart being simply weakened as to its innervation; in the organic, weakened both in its innervation and structure. The only remaining question is, what is the paroxysm? Is it a paralysis or a spasm? Many different theories have been, and are still held on this subject; but to the four principal ones only will we direct our attention. These are,—first, that it is a cardiac neuralgia or neurosis; second, a gouty attack; third, a spasm; and fourth, a paralysis.

Each of these theories we shall examine in their order, and attempt to demonstrate that the only way to understand the paroxysm is to prove it a paralysis. The first theory, that it is a cardiac neuralgia or neurosis, is maintained by the French school—Desportes, Jurine, Leallier, Lænnec, Lartigue, Trousseau, &c.—and by some distinguished men in our own country. At first sight it does

not appear so very unreasonable. The pain in angina is undoubtedly of a neuralgic character. The errors the supporters of this theory have fallen into, is in not distinguishing functional from organic angina, and in attaching too much importance to the præcordial pain. We can certainly call the former a neurosis, that term signifying that both the lesion and the paroxysm are mere nervous derangements; but we cannot do so in the case of the latter. Then the pain is only one of the symptoms, and one which naturally, from its severity, absorbs all the patient's attention, and frequently the medical attendant's also, and so has led them somewhat rashly to name the disease from its most prominent symptom. Besides, a neuralgia would not account for the history and symptoms of a case of organic angina, with its inevitably fatal termination, and the post-mortem appearance found on dissection. So, although in angina the pain be neuralgic, the paroxysm cannot for a moment be considered such.

The second theory is, that it is a gouty affection.

Butler was the first to advocate this opinion; but, since his time, Elsner, Schöffer, Schmidt, Regius, Hesse, and most of the German writers, have agreed with him. Formerly many affections were attributed to gout, as a cloak for ignorance, especially obscure cases of heart disease; but, in angina pectoris, we do not see how it can pride itself as serving its purpose even decently. In Scotland, where the gout is rare, angina is as common as in England, where gout is comparatively much more prevalent. In most of the cases of angina we have seen, there was no history of gout, while gout, we know, seldom affects the heart without having primarily manifested itself in other parts. Thus we see that, as a

direct cause, gout can have nothing whatever to do with a paroxysm of angina, though indirectly, it may by giving rise to dyspepsia. For, as we know that functional angina is often due to dyspepsia, there is no reason why gouty dyspepsia should not be looked upon as the occasional cause of these attacks. Many of the more powerful predisposing causes of gout, such as indulgence in fermented liquors and animal food, tend to produce degeneration and structural changes, and the long-continued existence of chronic gout also leads to a depraved condition of the general nutrition of the body. This tendency to degeneration is a cause of weakened heart, which is, in our opinion, the cause of angina; so that the gouty diathesis, by favouring this depraved constitutional condition which leads to degeneration and weakening of the heart, may be looked upon as a predisposing cause of angina. Otherwise it can have no relation to the paroxysm.

Having discussed these two theories, we have now a more difficult task before us—to decide whether the paroxysm is a spasm or a paralysis, it being now generally admitted that it must be one of the two. There has been a constant division on this point, especially among English authors, and many names of weight can be ranged on either side. Heberden, Latham, &c., were convinced of its spasmodic nature, and brought forward many arguments in its favour; while Stokes and Walshe, and some of the more recent writers, point to paralysis as the more probable cause of the paroxysm.

Dr Heberden, writing on this subject, gives us seven reasons for believing it to be a spasm, and, as most of his followers have but copied them, we shall take his list

and see whether or not they confirm his doctrine of spasm. They are—

1*st*, It comes suddenly and goes suddenly.

2*d*, It has long and complete intermissions.

3*d*, Wine, spirits, and opium give great relief.

4*th*, It is increased by mental agitation.

5*th*, It exists for years without other injury to the health.

6*th*, The pulse is not quickened in the very paroxysm.

7*th*, A paroxysm attacks some after their first sleep,—a frequent event in diseases which proceed from spasm.

We shall examine these arguments separately, in order to find how far they support the spasm theory, and if they are in any respect incompatible with that of paralysis.

The first is—It comes suddenly and goes suddenly. Most assuredly the paroxysm comes suddenly, frequently without a moment's warning, while, although paralysis may come suddenly, it generally goes away gradually. Now, why does paralysis disappear slowly? Is there no exception to this rule? and, if there is, may not the paroxysms of angina pectoris be one? Paralysis, when it does disappear, does so usually in a very gradual manner, because, generally speaking, the lesions causing it, as extravasated blood, effusion of serum, or inflammation and its products, can only, if at all, disappear slowly by reabsorption or resolution of the inflammatory process. But if, on the other hand, the cause of the paralysis can be suddenly withdrawn, there is no reason why the paralysis should not as suddenly cease. In angina the paroxysm is due to a sudden and temporary strain being put upon an organ in a condition so weakened as to be unable to resist it, but the cause being temporary, and ceasing the moment the paroxysm comes on, the recovery is sudden.

The history of the paroxysms, occurring in the earlier stage of the disease, shows this to be the case. The patient is seized with a paroxysm when walking rapidly or going up hill, and almost as soon as he halts the attack is over. Here the over-exertion is the direct exciting cause, and when that is withdrawn the heart, in the commencement of the disease, immediately recovers itself, and the paroxysm ceases. But, as the disease advances, the recovery is not so rapid, the heart being more enfeebled, and not in so favourable a condition as formerly for regaining its irritability, so that Dr Heberden's first argument does not favour the doctrine of spasm more than that of paralysis.

The second reason is—It has long and complete intermissions. Has it? Not always; and when it has, it is only at the very commencement of the disease, or in the functional cases, when the patient is under strict surveillance as regards exercise and diet, any indiscretion in either being apt to bring on a paroxysm. As the disease advances, the paroxysms become much more frequent, and the interval diminishes. Over-exertion, over-eating, and mental emotion, are some of the more common exciting causes of the paroxysm. So, naturally, if a patient suffering from this disease finds what in his case is the exciting cause of an attack—as he soon does—he can, if possessing self-control, determine at first, to a certain extent, the length of the intermission. But, as the disease advances, the interval diminishes, because a much smaller amount of exertion, physical or mental, will now bring on a paroxysm. Hence the completeness and gradually diminishing interval are the symptoms we would expect from a temporary paralysis, and not from a spasm of the heart.

The third reason is—That wine, spirits, and opium give great relief. This is perfectly true, and stimulants ought to be equally efficacious, whether it is a spasm or paralysis; for, looking at the symptoms of a paroxysm—face pale, pulse small and feeble, and fear of syncope—we ought to see that stimulants are strongly indicated. Opium, we know, produces stimulation of the vascular and nervous system, as shown by increased fulness and rapidity of the pulse, then relief from pain. Accordingly, whether it acts as a stimulant or anodyne, it is evidently a suitable remedy for the alleviation of a paroxysm of angina, even if it were a paralysis. And by experience we know it is the only treatment we can at present rely upon.

The fourth reason is—That it is increased by mental agitation. Spasm is frequently increased by mental agitation, but only, as a rule, when the seat of the lesion is cerebral, as in epilepsy, chorea, &c., for we do not find that spasm is aggravated by mental agitation when it occurs in an organ or part in which the lesion or cause of the spasm is a local one, as in colic, and cramp in the limbs from over-exertion. So in angina, as the lesion is purely local, mental excitement should not bring on or increase the paroxysm, yet it invariably does, therefore we ought to infer that it is not a spasm, and, if not a spasm, it must be a paralysis.

The fifth reason is—That it exists for years without other injury to the health. It may, to a certain extent, in the functional, but not in the organic; for injury to the health must and does follow the suffering, mental and bodily, which accompany it, and the secondary derangements which so commonly follow in its train. And to such a degree is the health sometimes impaired by these

causes, that the patient succumbs, not to the paroxysm, but to some of the secondary lesions. But even if it did not injure the health so severely as we have said, there is no reason why a paralysis should entail more serious consequences than a spasm.

The sixth reason is—That the pulse is not quickened in the paroxysm. Generally speaking, it is not; and this is just what we should expect if it were due to a paralysis. In the few cases in which it is quickened, the beats are very feeble, the acceleration being due to a greater degree of weakness of the heart in these instances. As Dr Graves has shown that the maximum of strength and minimum of frequency are attained together, so these two conditions of the pulse, seemingly contradictory, are thus quite easily reconciled.

The seventh reason is—That a paroxysm attacks some after their first sleep—a frequent event in diseases which proceed from spasm. This last argument is not very convincing. It says the paroxysm attacks some after their first sleep, and that this is frequent in diseases due to spasm. Now, if it is frequent in diseases due to spasm, it ought to be frequent in angina. But no, it only attacks a few after the first sleep. Moreover, the attacks are liable to come on at any time, so why not occasionally at that time. And if a patient suffering from angina should waken with a start, as those affected with heart disease often do, we have a direct exciting cause of the attack in the mental emotion induced by the start, so that a paroxysm attacking some after their first sleep does not by any means imply that the paroxysm is a spasm.

Having thus taken each of Dr Heberden's reasons for believing it to be a spasm, and examined them sepa-

rately, we have not found one which in the least degree excludes the possibility of its being a paralysis, but some which seem rather to strengthen the probability. We shall now endeavour to turn that probability into a certainty.

When we see a patient during a paroxysm of angina, in what condition do we find him? His face is pale, sometimes bedewed with clammy sweat; his look is anxious, expressing great bodily and mental suffering, and he is afraid to lie down, not so much from dyspnœa, as from the fear of his heart stopping to beat, as he expresses it. On examining the circulatory system, the heart, we find, beats more feebly than is natural, the impulse being weak, and hardly, if at all, perceptible. In a few cases it appears slightly tumultuous. These few cases are, however, exceptional, and only occur when there is hypertrophy of the heart from valvular disease, or dilatation, or aneurism of the aorta, on which degeneration of the heart has supervened. In these cases the action of the heart is observed over a larger space than natural, nearly the whole ventricular, and not the apex beat alone, being visible. This strikes us the more forcibly when we compare it with what we usually observe in angina, when the heart is merely softened or atrophied, without any counter-balancing hypertrophy being present. And when this visible pulsation is accompanied by an occasional intermission or irregularity, it gives a still greater appearance of reality to this quasi-tumultuous action.

The pulse is found to vary considerably in different cases. Sometimes it is regular, sometimes irregular; in one patient frequent, in another slow; but as a rule, it is not increased in frequency more than four or five beats; though an increase of twenty has been observed, accord-

ing to Walshe. In fits destined to terminate fatally, it becomes almost imperceptible, occasionally altogether suppressed; most commonly, it is small and weak. Are these the symptoms we should expect in spasm? We think not. And why? Because if it were a clonic spasm, the sudden contractions would give the pulse a quick jerk. Then, in the relaxation, it would fall to, or below its normal standard, thus causing a great variation in the strength of the radial pulse, but this we never find. It would also act irregularly if it were a clonic spasm. Now, we know that this last symptom is not by any means a constant accompaniment.

Then, if the spasm were tonic, a heart so affected could not continue to beat, and continue to beat so regularly for the length of time some of the paroxysms last, especially when they are frequently repeated, and continue through a course of two or three years or longer. The result we should look for and expect would be almost instantaneous death on the first seizure. Or, if it were a spasm of only one or more of the cavities of the heart, but not involving the whole organ, the action of the cavities not spasmodically affected would be greatly increased to compensate for the inaction of the others, and we should then have symptoms of congestion due to the mechanical obstruction to the passage of the blood. But we never have these symptoms; the face is always pale, never congested, unless very slightly, if the paroxysm is a very protracted one. Still, in a paralysis of a portion of the heart, these symptoms would also apply; but as they are never present, even in a modified degree, we think that this shows that during a paroxysm of angina pectoris the whole heart is in a state of paralysis to a greater or less extent. Thus we see that the

symptoms we should expect in spasm of the heart may be arranged as follows :—

If tonic spasm of the entire heart—Death in the first attack inevitable.

If tonic spasm of one or more cavities, but not of the whole heart—Irregular and greatly increased action of the cavities not affected. Venous congestion, and tolerably strong impulse.

If clonic spasm of the entire heart—Quick, sharp beat, followed by a small feeble one ; this continuing throughout the entire paroxysm. Irregular action.

If clonic spasm of one or more cavities—Constant irregularity, and venous congestion.

But we cannot place a paroxysm of angina pectoris under any one of these four conditions as agreeing with the symptoms. Then, if we look at the nature of spasm, I think we find some points that contra-indicate the paroxysm being of that nature.

The first of these is local spasm, by which we mean a spasm occurring in a part in which the lesion or cause is also situated, as distinguished from spasm due to irritation or disease of distant organs or tissues. Cramp in the exhausted or over-strained muscles of a limb is an example of the former. In cases of local spasm the spasm occurs in muscular substance unimpaired in its structure, while in patients where there is degeneration of the muscular fibres, as in muscular atrophy, or in wasting from paralysis, spasm is rare, but in weakened heart the paroxysms of angina are very common. Again, spasm is frequently excited in a part structurally quite healthy by irritation or disease of a distant organ or part, as spasm of the glottis, in disease of the larynx, spasms in epilepsy, chorea, &c. ; but in cases of organic angina, we never

have organs or parts diseased, which by irritation or otherwise have ever been proved to produce spasm of the heart. We have shown, too, that spasm depending on disease of a distant part usually attacks healthy structures, while the heart in angina is always in a morbid condition.

Again, an attack of angina is always aggravated, and the pain greatly increased, by muscular exertion, which is also very often the exciting cause of the paroxysm, while spasm, frequently the result of undue muscular exertion, is relieved by increased or forced motion of the part affected. This many have experienced, as when suffering from cramp in the leg, the readiest method of affording relief is by forced extension and movement of the affected limb; also in colic, friction of the abdominal walls gives relief by the movement of their contents. In an organ already weakened, over-exertion is very liable to cause a temporary increase of debility, and naturally this is increased if the organ is still kept in action, but as soon as it is placed in as favourable a position for rest as possible, relief is given; and such, we find, is what takes place in a paroxysm of angina in the first attacks of the disease. Then, if we look at the progress of the disease in the organic cases, we can do nothing to prevent the paroxysm gradually becoming more frequent, each one occurring after a shorter interval than its predecessor. This a paralysis naturally explains, but not so a spasm, which, when it does occur in an organ, does not follow this regular course, neither in the increasing severity of the attacks, nor in the gradually diminishing interval between them.

Lastly, let us examine the post-mortem appearances of the heart found in patients who have died during a paroxysm of this disease. In all reported cases we do not

find one in which the heart or a portion of it was contracted on itself after death, but quite the reverse, the heart being always flabby and unusually flaccid, frequently with clots in the cavities, showing how feebly it must have been acting previous to dissolution.

Professor Smith relates a case of tetanus, in which, after death, the heart was found so firmly contracted on itself as to cause obliteration of the cavity of the left ventricle, and so twisted as to present a spiral condition from the extreme contraction of the oblique muscular fibres. Now, this is a case of a spasmodic disease affecting the heart, in which, after death, we find it still remaining in a state of contraction. So it is surely but reasonable to expect that we should find the heart in some of those who have died in a paroxysm of this disease in a state of partial or complete contraction; but no such condition has been noticed as yet, or at least described. Nor is it at all likely that spasm could change at the moment of death to syncope, which is always the immediate cause of the fatal result.

Having thus stated my arguments, I shall now briefly sum them up. Not one of Heberden's reasons for attributing the paroxysm to spasm excludes paralysis, while some rather favour the idea of paralysis. Our arguments for paralysis, on the whole, exclude spasm; and although, perhaps, we may not have given any one fact which is by itself conclusive, it is because so little is known of spasm of the heart that probable conjectures are all that can be made on some points in the present state of our knowledge. Still, by the careful study of spasm in other organs and parts, we are entitled to judge what would, to a certain extent, be its effects and symptoms in another organ, so that our probabilities become very

reasonable ones, and do not invalidate our arguments as a whole. And as it must be either the one or the other —a spasm or a paralysis—no other theory which has been proposed being able to account for the symptoms and history of the disease, we think we are justified in saying that it is a paralysis occurring in, and depending on, a weakened heart.

Treatment.—During the paroxysm the treatment most efficacious in relieving the symptoms is that by diffusible stimulants and opium, hot brandy and water, sinapisms to the feet, and placing the hands in hot water. In the functional cases, treatment must be directed to the stomach and nervous system. Tonics, such as iron and quinine, and regular exercise, will be found most beneficial.

Trousseau, in his work, mentions some good results he obtained by galvanism; but from the reports of the cases operated upon they must have been functional simply, as it is only in these cases that cures could be effected. Still, we are inclined to think that galvanism carefully, and, at first, gently applied, might be of some service even in organic angina, by giving stimulus and tone to the muscular fibre of the heart, and that, at least, it is worthy of a trial. Another remedy we would suggest is bleeding. By relieving the languid and stagnating circulation you ease the heart, and at the same time give it a stimulus and opportunity of recovering itself, especially when the paroxysm is a protracted one. Nitrate of amyl is also of some service occasionally. It acts as a stimulant—its speedy action being due to the method of administration by inhalation.

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